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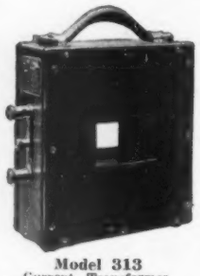

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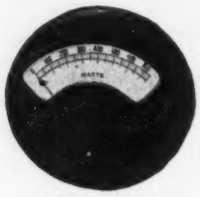

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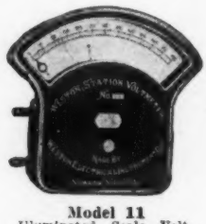

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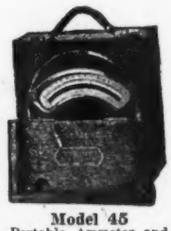

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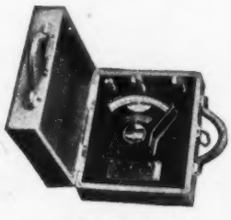

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Profiting from Failure

NOT to talk about failures is human nature. Still, what better way is there of finding out what not to do and how to avoid the pitfalls that engulfed our grandfathers? Exchange between operating men of experiences that were not successful as well as of those that were may often prevent fresh mistakes. The Northwest is setting an example in telling what not to do in burning hogged fuel and powdered coal. Let all engineers follow the spirit of the progressive West and give others the benefit of what they have learned.

Spreading the "Self-Interest" Idea

THE "self-interest plan" is producing results on the Pacific Coast in popularizing public utility securities. Why should it not be adopted nationally? When people are asked to invest they naturally have to be shown the benefit. If the immediate return on their money cannot be made sufficiently attractive, the indirect returns to them from station development must be made clear. This is not difficult. It is being done, but not extensively enough. The central-station company can itemize a dollar spent in its development and point out to manufacturers where they will receive new business that may not be created if they will not help finance the project. Going further, each producer of a raw product required in the equipment used may be shown where he will make more sales. Every class of labor can be shown where it will find a market for its services in the production of material for the proposed development. If a company will only explain where the money spent for construction goes, it will find little difficulty in developing "self-interest" in public utility securities.

The Manufacturers' Political Program

SMALL direct trace of the nine-plank platform on industrial issues adopted by the National Association of Manufacturers and advocated by it before the resolutions committees of the Republican and Democratic national conventions can be found in the declaration of principles adopted by either of these political parties. In this respect, however, the manufacturers' proposed planks did not fare worse then those submitted by various other associations of citizens, including labor bodies. The platforms of both parties, it is needless to say, are enthusiastic for progress, reform and retrenchment. They always are. When it comes to specific promise on industrial problems they are alike elusive and non-committal. However, neither platform squints in the direction of government ownership or operation of industry, opposition to which was the manufacturers' first plank, while both platforms declare for a sweeping revision of war taxation, for intelligent handling of transportation problems, for encouragement of foreign trade and for an enlarged merchant marine. With such crumbs of comfort, so far as the proclaimed articles of Republican and Democratic belief in 1920 are concerned, the National Association must content itself as best it can.

Progress Phenomenal

DETROIT'S spectacular jump from the ninth to the fourth place among the cities of the United States and from less than half a million to nearly a million inhabitants stands out as the most striking fact disclosed by the 1920 census of population. Thirty years ago Chicago made an equal record, but never since has so large a city doubled its population in ten years. Naturally the public utilities had their work cut out for them in keeping up with this rapid growth. The problem would have been great had everything save the rate of increase been normal. When in the latter part of the decade the war made every condition abnormal the difficulties became tremendous. Difficulties, however, do not terrify the American central-station manager but put him on his mettle. The Detroit Edison Company, under the guidance of Alex Dow, rose to the occasion, obstacles were overcome, and the system expanded with the city. In 1909 the total gross earnings of the company were $2,199,143; in 1919 they were $16,498,391. The output rose in the same decade from 86,882,900 kw.-hr. to 872,500,000 kw.-hr. a year. The investment now totals $62,520,624, including the two great plants, Delray and Connors Creek. Besides Detroit itself, the company serves six near-by cities and more than forty villages, some of which—notably Highland Park and Hamtramck—have grown at a rate far greater even than that of the Michigan metropolis itself. The company's achievement is an encouraging exhibition of successful enterprise on a vast scale.

Interconnection in France

IN ANOTHER column this week there is printed an account, based on an article in *Le Génie Civil*, of the French government's proposals for the rehabilitation of the electrical systems in the devastated sections of the republic. The government's intention is to afford liberal state aid in the building of power houses and transmission lines to take the place of those destroyed by the invaders, and eventually to supply electrical energy not only to the ruined districts but to contiguous districts in Lorraine and in the region of Paris. The total length of network is to be almost a thousand miles and the cost is put at 135,000,000 francs. Perhaps the most interesting feature of the plan is that by which the territory covered will be served, not by a series of disconnected systems, but by a uniform and interconnected network with all the advantages of economy and efficiency thereby attained. The greatest of evils some-

times bring with them a small amount of compensation. Against the ruthless destruction by the Germans may be set as a slight alleviation the fact that it has rendered easy in the northeast of France what vested interests will make very difficult in other parts of the nation when the Government is ready to go forward with a still more extensive plan that it has prepared.

Pitfalls Engineering Societies Should Avoid

AMONG many prominent engineers there was an attitude of indifference to and lack of confidence in the work of the organizing conference of engineering societies before it so successfully ushered into being the Federated American Engineering Societies at Washington, D. C., as reported in the ELECTRICAL WORLD June 12. In one case no representative was present because the organization involved felt that the program was so full that proper discussion could not be had and that therefore the expense of representation was not justified and men of the right caliber should not be asked to give up their time. This is not, we think, the kind of thinking that should be displayed by members of influential engineering organizations. There is an apparent development of two types of ideas that will need careful attention as the work of the new federation is planned. The first is the type that can direct results only through the individual societies; the other is of the far-seeing character that is willing to search out the defects that have hindered the engineer's progress, and carefully and thoroughly correct them in the most effective way. To this type the new federation is that most effective way. Men who think on these lines foresee the necessity of a long and patient schooling, including thorough and honest self-analysis, that has no appeal to the radical type. A clash between these two schools is inevitable, and unless the vast body of soberly thinking engineers take an active part and control the discussion there will be a battle royal between the extremists of both factions.

If the individual engineer is to be educated to a broader point of view, the problem is much more than a question of co-operation between the various engineering bodies. It becomes a question of co-ordination of all engineering activities, which is a propostion reaching very much farther. Co-operation means essentially the working together of equals, with neither surrendering the right to independent action should self-interest demand it. Co-ordination means the surrendering of certain individual prerogatives and the submission to the authority of a superior for the common good. This, more often than not, means the subordination of self-interest. The whole question involved in the movement of engineers to attain a higher standing for their profession is a movement for the common good. If it is to be successful, controversies that will attract the attention of the fight-loving onlooker must be avoided. This does not mean suppressing discussion, for complete and thorough discussion is an essential to the development of the problem; but it does mean the existence of somebody that will be recognized as having authority to hold the discussion within proper bounds, co-ordinate the work that may be undertaken, and insure the elimination of any moves directed primarily toward the self-interest of this or that group. That body is the Federated American Engineering Societies, an organization that already represents the co-operative and co-ordinating thinking of more than three score individual societies and clubs. It may be that as time goes on and this body extends its activities the hitherto jealously guarded prerogatives of the organization that are or may be involved will be called into question and conditions will be found such that some of these will be trampled under foot. In meeting these conditions the ability that the engineer has acquired in studying physical facts and accepting the conclusions they force will be subjected to a severe test. If the situation is faced with the same honesty of thought and breadth of vision with which engineering problems in general have been faced, the answer will never be in doubt. On the other hand, if self-interest and petty prejudice rule, the movement will gather the momentum it deserves slowly and the great good that can be accomplished will be unnecessarily delayed. Indifference and lack of confidence in the new organization form a type of resistance that sooner or later the large current of opinion will overcome. It will be well for every engineer to bear in mind the trite saying, "The mule makes no progress while he is kicking," and urge the societies with which he is affiliated to join the ranks of the new federation and actively take up its work.

Tariff on Scientific Instruments

THERE has recently appeared in one of our English contemporaries a most interesting discussion to which America should give serious consideration. England, next door to the Continent and quick to resume commercial relations, was early to feel the pressure of Continental competition, made all the more active by the difference in exchange, especially in the vanishing value of the mark. As protection against this extraordinary condition an anti-dumping bill is under serious consideration whereby apparatus of foreign make is to be excluded entirely except as imported under license on showing that similar articles of equally good quality and of British manufacture cannot be regularly obtained. This is akin to the suggestion made here that, granted a stiff tariff, this tariff should be lifted in cases where the American manufacturer does not regularly produce articles of quality equal to the foreign.

In the correspondence alluded to the attitude of important British manufacturers toward a tariff as against the proposed prohibition is extremely interesting. One, of worldwide reputation, puts the case thus: "We have very little sympathy with those who would bolster up our industry by levying heavy duties on imports, and we think that the result of such a policy would be to increase the cost of home-made goods without improving their quality; but there is a good deal to be said for preventing goods made abroad being dumped in this country at prices lower than those prevailing in the country of their origin." Another manufacturer, equally well known, says frankly that individual pieces of apparatus equal to any produced on the Continent have certainly been produced in England, but that only a very small proportion of the supply ever reached that standard, and goes on to enforce this wholesome statement of fact by intimating that the purchasing public would have no reason for buying foreign-made instruments if the English standard of inspection were higher. What is true of England is also true here.

Co-operation in Power Supply

A PETITION made some time ago by a street-railway company in Massachusetts for authority to sell energy in bulk in the general commercial field was vigorously opposed by central-station interests on the ground that the policy of the state has long been one of declared demarcation between these different classes of utilities, allowing the business of electrical supply to be and continue a regulated monopoly within a stated territory upon the condition of adequate and satisfactory service. In cases of this kind an *entente cordiale* between the central-station interests and the railway company, in order that the ideal capacity may be as far as practicable utilized and the industrial power needs of the district be met in a wholesale way, is worth working for. A railway company may have the right to organize an independent power company and so to proceed in competition with existing agencies if it so desires; but its chances of success would seem to be far greater if a satisfactory operating agreement could be entered into whereby the energy generated in its steam plants could be distributed by the existing electric service utilities. Where the latter are meeting their requirements well the local authorities, and probably the state commissions, would be slow to indorse the entrance of a competitor. A better way lies along the line of co-operative production and distribution, with interconnection and maximum use of existing facilities as the basis of enlarged and improved service.

Increasing Rupturing Capacity of Circuit Breakers

AS STATIONS have grown bigger and bigger the circuit-breaker difficulty has increased almost in geometric ratio, and the time is apparently drawing near when, unless improvements are made, the apparatus to protect the generator will cost more than the generator itself. In view of this serious situation experiments to determine the rupturing capacity of circuit breakers on short circuit are evidently worth the while, and if they can show means for increasing the emergency capacity a considerable saving can be effected.

Some very interesting tests have been conducted in Chicago to obtain higher switch rating, and the results are briefly related in this issue by C. J. Hejda. A 300-amp. nominal breaker was connected to three-conductor cable short-circuited between two phases and fed by a 12,000-volt, 20,000-kva. generator which was started at reduced voltage and pushed upward step by step until the breaker began to give trouble. With the breaker regularly equipped this point was reached on short circuit at about 10,000 volts. The ordinary transil oil was then removed from the breaker and another liquid substituted consisting of a chlorine derivative much less volatile than carbon tetra-chloride. The repetition of the tests under this condition showed material improvement because the breaker could handle fairly a short circuit at the normal pressure of 12,000 volts.

As another modification hollow contact rods were used, having a pressure venting device at the upper end closed normally by a weighted valve capable of opening freely under pressure in the well. With the tubular rods the gas pressure created in the well by the arc forces the liquid across the arc into the tube and the gases can escape through the vent. In addition to this device the new filling liquid (chlorine derivative) again produced material improvement in the operation of the break. Finally, extra pressure vents set to release at about 150 lb. were provided in each well, and when the breaker was operated this pressure seemed to be about the limit of that reached in the well, showing the effectiveness of the venting in the hollow electrodes. In general it was found that the increase of working capacity by change of liquid and the use of hollow vented electrodes approximated 50 per cent increase in kva. rupture, a gain of no small consequence in installing a station of large capacity.

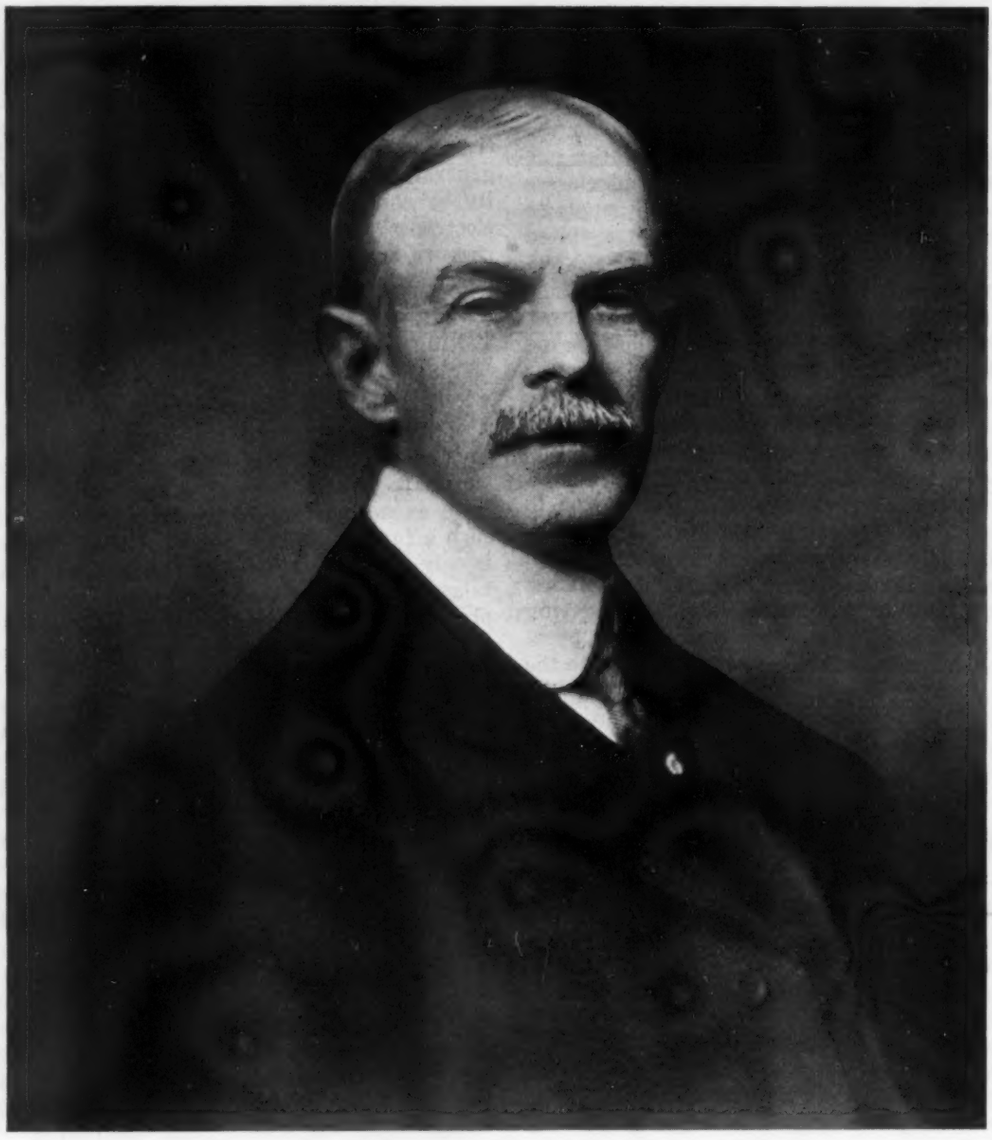
Taking Full Advantage of Relays

IN THE last few years marked results have been obtained by the application of relays. In the early days of central-station development relays were utilized mainly to protect generating apparatus or transformers from excess current by operating oil switches. While such a function is still a part of the duties of relays, it is only a small part. Later the idea was conceived that relays should not only protect apparatus but should also protect service by disconnecting automatically any portion of a line when trouble occurred. The principle was first applied to parallel lines and to very simple networks. Now experience has proved that, with judicious use of relay timing and various relay actions, protection of service can be given to an elaborate network. The possibilities of such dependence on relays appear to be quite unlimited in scope.

The proper use of relays results necessarily in interconnection. During the war the value of interconnection between companies to effect a transfer of power to the places where there was shortage was vividly realized. In this manner of operation also it was found that economies were obtained by taking advantage of the diversity factor between the loads of the connected plants. Exactly the same advantages are present inside of any one system. It should also be remembered that operating many lines in a network reduces the losses of the system as a whole and that the actual saving in energy losses may be of great magnitude. It is fair to assume in nearly all instances that any expense incurred in providing relay installation will be repaid manyfold through the saving in energy losses.

Many operators have objected to operating any considerable portion of their system as a connected network for fear of service shutdowns due to the failure of some relay to operate; and they have seemingly been justified by some very serious accidents that have occurred where interconnection has been practiced to a large extent. It would be hard to prove that the shutdowns thus caused were more costly to the companies than the continuous cost of operating many disconnected lines. Nevertheless, it is evident that such shutdowns should not occur, and therefore success in interconnection will depend largely upon the care taken in the installation and setting of relays and an ever-vigilant inspection system.

Means must be found to insure relay operation rather than to condemn the practice of interconnection on such weak ground as that just mentioned. Better service, a saving in line investment and a large saving in energy losses can all be credited to proper use of relays. Not only the necessity of meeting increased costs but the duty of practicing conservation makes this incumbent.



Francis Bacon Crocker

Pioneer in electrical manufacturing, educator and father of American electrical standards

AS FAR back as 1886, when the electric motor was just beginning to be used commercially, F. B. Crocker was thinking of standardization. In that year the C. & C. Electric Motor Company, in which he was a partner with Charles G. Curtis, produced under standard specifications 100 ¼-hp. motors, probably the first standardized output of the kind. Professor Crocker, then head of the department of electrical engineering of Columbia University, became ten or eleven years later chairman of the first standardization committee of the A. I. E. E. This committee drew up the original standardization rules of the Institute. Later Professor Crocker was chairman of the committee which revised these rules. He was also chairman of the conference of insurance and engineering representatives that formulated the National Electrical Code. Had he done nothing else, the excellence of this pioneer work in standardization, the groundwork of which has remained virtually unchanged for almost a quarter of a century, during which time the industry has undergone a most remarkable period of enhancement and advancement, would be sufficient to make his name immortal in electrical history. Besides this, however, Professor Crocker is considered one of the best posted men on electrical patents. While he has not taken out many patents in his own name, he has been able to aid greatly in the development of many uncompleted devices which have been brought to him. He has contributed much to technical literature, his best known work being probably a two-volume treatise on "Electric Lighting." Moreover, it was he who proposed the name of "henry" for the unit of inductance.

Professor Crocker has given unusual service to the profession of electrical engineering. In addition to his other activities, he has served the A. I. E. E. as president and as manager as well as having been vice-president for two terms. At the World's Columbian Exposition, in 1893, he was made permanent secretary of the International Congress. He was active in the first standardization congress held in London in 1906 and is now American vice-president of the International Electrotechnical Commission, which will hold its plenary meeting this fall in the United States. He is one of the pioneers in the electrical manufacturing industry. Besides establishing in 1886 with C. G. Curtis the C & C Electric Motor Company, already referred to, two years later with Dr. S. S. Wheeler he formed the Crocker-Wheeler Electric Company. He is also past-president of the Electric Power Club.

Professor Crocker celebrated his fifty-ninth birthday on Sunday last at his summer home on Cape Cod.

Technical Sessions

of A.I.E.E. Convention at White Sulphur Springs

Abstracts of the Papers and Discussions to Which Three Days Were Devoted—Problems of Reactor Layout, Temperatures in Electrical Machinery, Selection of Excitation Systems and Progress in Electric Welding Draw Animated Discussion from the Members—Papers Covered Live Engineering Subjects

ENGINEERING problems having a direct application to modern electric power and industrial systems were discussed with enthusiasm in the technical sessions of the convention of the American Institute of Electrical Engineers at White Sulphur Springs, W. Va., last week. Six general sessions dealt with electrical machinery, protective devices, electric welding, power factor in polyphase, unbalanced systems, excitation methods and miscellaneous subjects.

Of particular interest were the papers dealing with the use of power-limiting reactors in central stations. The contributions of R. F. Schuchardt and Dr. C. P. Steinmetz, dealing with stability of operation of large central stations, were given rather fully in the July 3 issue of the ELECTRICAL WORLD. The subject attracted particular attention because of the present rapid growth of interconnected systems and its bearing on the super-power-plant problem.

A report by Philip Torchio of failures of large turbo-generators, dealing with their causes and remedies, added a very practical aspect to the problems of temperature detection and control in electrical machinery. At the excitation session chief interest was centered in recent tendencies toward the use of direct-connected exciters for hydro-electric plants and the operation of exciters separately rather than on a common bus. A comparison of excitation systems by J. T. Barron and A. E. Bauhan, giving advantages and limitations of each, will be reported in more complete form in an early issue of the ELECTRICAL WORLD.

HIGH-TENSION INSULATOR PORCELAIN

Mechanical strength is obviously one of the prime factors to be considered in insulator material, said W. D. A. Peaslee, adding that under the stimulus of the demand of transmission engineers certain types of porcelain bodies are now available whose strength runs from 65,000 lb. per square inch (4,550 kg. per sq.cm.) in compression to 12,500 lb. per square inch (875 kg. per sq.cm.) in tension. This is not the ultimate limit according to present indications.

Many insulator failures are traceable directly to inability of certain porcelain bodies to resist sudden changes in temperature, Mr. Peaslee continued. Any porcelain when completely equipped with hardware should be able to withstand an indefinite number of alternate immersions in boiling and freezing water. The statement that non-porous porcelain cannot be produced was denied.

One of the most baffling characteristics of insulators is the deterioration of seemingly perfect units after a time and the acquiring by non-porous porcelain of a certain porosity. Some recent investigations indicate that this may be intimately connected with the Piezo electric qualities of quartz crystals.

THE CORONA VOLTMETER AS A SECONDARY STANDARD

A series of experiments were described by J. B. Whitehead and T. Isshiki in which the values of corona-forming crest voltages were determined by precision measurements made in the high-voltage circuit. These showed that the law followed is so definite and the indications of the instrument so constant that it constitutes not only an accurate measuring instrument but also, through the results of the present investigation, a natural secondary standard of high voltage possessing many advantages over others in present use.

In a study of large corona rods, especially at higher pressures, it was found that plotted data departed from the straight-line law which had been established for smaller rods at lower pressures. The fact suggested either a departure from the simple corona law or the presence of some error in the method of observation.

C. L. Fortescue commended the work of developing the corona voltmeter for use as a secondary standard, but pointed out that a galvanometer is required in the measurements—a device too delicate for ordinary work. The sphere gap, he said, is accurate enough for most purposes and the kenetron method is suitable if there is no zero point in the half wave of voltage.

Dr. A. E. Kennelly called attention to the fact that corona may be detected by the eye, ear or nose, but that in the present instance electrical instruments may be used to detect ionization instead of the physical senses.

The use of the corona voltmeter for the measurement of impulse voltages such as lightning discharges is limited, according to J. Slepian. It was, however, maintained by F. W. Peek, Jr., that transient discharges having a duration of the order of one-millionth of a second can be detected by visual corona. Mr. Peek felt that the crest-voltmeter was accurate enough for practical purposes. L. W. Chubb said that the corona voltmeter should prove to be a good standard. Work is in progress to replace the galvanometer by an ordinary indicating instrument, Dr. Whitehead informed the delegates. In the hands of unskilled observers he recommended the telephone method of corona detection.

SPEED AND POWER-FACTOR CONTROL OF INDUCTION MOTORS

The use of neutralized polyphase commutator machines to control the speed and power factor of wound-rotor induction motors was explained by John I. Hull with the aid of circle diagrams. It was first shown

how speed and primary power factor depend upon induced voltage in the secondary and then how voltages may be introduced into the secondary from suitable sources to get whatever speed characteristics may be desired. Power factor is controlled by the same means.

Mr. Hull considered single-range speed (below synchronism) and power-factor control by means of a constant-speed series commutator motor, a constant-speed shunt commutator motor and a constant-speed compound excited commutator motor. He also showed how the double range (all speeds above or below synchronism) could be obtained by means of a constant-speed shunt commutator motor.

The quantitative relation between reactive power and the magnetic field was given by Joseph Slepian, and its utility was illustrated by several examples. The total reactive power is directly related to the volume of iron in electrical machines, whereas in a condenser circuit it is related to the volume of dielectric in the condenser.

Concerning the definitions of power factor, Mr. Slepian favored: Power factor is the cosine of the angle of lag between the direct-rotational component of voltage and the direct-rotational component of current. With this definition, a balanced rotating machine will show the same power factor irrespective of the voltage unbalance.

Electrical Machinery Session

PROBLEMS *of temperature and ventilation of large turbo-generators were considered and the contributing causes of failures in the cases of fifty-five large generators were classified. Some excellent experimental work was reported which throws light upon the best methods of installing detectors for the determination of maximum temperatures in armature coils. It was shown that it was impracticable to get actual maximum temperatures, but relative temperature rise may be estimated when the most serious sources of error are avoided.*

PHILIP TORCHIO classified fifty-five generator failures of which he has a record or report. The machines were installed in different parts of this country and their capacities ranged from 5,000 kw. to 30,000 kw., the smaller size dating back from twelve to sixteen years and the larger being of more recent manufacture.

The failures, several occurring on the same unit, are summarized as follows:

Mechanical damages	3	
Heating of windings	17	
Heating of iron	2	
Loose laminations	1	
Moisture in cooling air	3	
Corona shield breaking	2	
Heating at end turn clamping	1	
Overload damaging end turns	2	
Causes undiscovered	2	33
Field failures due to:		
Open-circuited connections	3	
Grounding	7	
Grounding caused by bus short circuit	4	
Loosening of damper windings	2	16
Armature and field failures due to:		
Moisture	1	
Undiscovered	3	4
Terminal failures due to:		
Moisture	2	2

To avoid similar troubles, designing engineers should use insulating materials of proved dependability, maintain low copper temperatures, by proper subdivision of copper and transposition of strands in windings, and provide liberal ventilation throughout the machine. The operating copper temperatures should be limited at or closely to 100 deg. C. Too great a range of operating temperatures is bound to cause generator failures. Mica insulation in hydro-electric generators operated at steady load will last indefinitely at high temperatures, while under similar conditions mica insulation in steam turbo-generators operated intermittently will fail.

If operating companies are finding that generator failures are caused by excessive temperatures, said W. J. Foster, they can reduce the heating considerably by improving the power factor—an increase from 80 to 100 per cent almost halving the energy loss. With the specifications regarding output and power factor it is almost impossible to limit the copper temperature to 100 deg. C. Furthermore, the insulation test of the three times normal plus 1,000 volts, prescribed by Mr. Torchio, would require such thick insulation that reduced heat conductivity and increased eddy-current losses due to the greater magnetic leakage would result.

F. D. Newbury contested the statement of Mr. Torchio that excessive temperatures are the chief cause of generator failure except where machines are purposely overloaded. To substantiate his contention he presented observations regarding all Westinghouse generator failures for the last seven years involving units rated at 15,000 kw. and more, saying that the manufacturer accepted the responsibility for eight out of a total of twenty-two, the users accepted the responsibility for eleven (caused by outside fires, abnormal voltage surges, ice and water and overloads), and three cases were in dispute as to cause. The majority of failures were caused by operating hazards and not armature heating. In the cases involved one-third of the failures were in 11,000-volt units or higher ones, and two-thirds were in units of lower voltage.

Where failure of insulation has occurred, W. F. Dawson said, abrasion of covering and air voids are serious contributing causes. He advocated mica insulation for 4,000 volts and higher.

Philip Torchio called particular attention to the fact that assuring reliable operation is vastly more important than getting the maximum rating out of a certain mass of metals.

B. G. Lamme pointed out some of the problems in turbo-generator ventilation practice, without taking up the quantitative solution of such problems. In radial

ventilation all air must flow through the gap, and this makes it necessary to use high air pressures for machines of compact design. Another difficulty is that equal quantities of air do not flow through all of the ducts along the length of the stator and that air temperature is higher when it reaches centrally located ducts. In axial ventilation the tendency is toward the use of many axial ducts for the passage of air rather than a few large ones, he said. Most ventilation systems are a combination of the two methods. He pointed out that, theoretically, the air should be coolest where machine temperatures are highest—that is, near the center—but, while this has been impracticable, radial is somewhat better than axial ventilation in this respect.

Both the length of air passage to the parts to be cooled and the effectiveness of contact must be considered. In case of laminated iron, air passing through ducts parallel to the laminations is far more effective than air flowing across the ends.

The characteristics of insulation and metal in heat conduction help to equalize the higher temperatures at the center of the machine, particularly with rotors of moderate length. Heat flows readily toward the end connections in the copper and far more readily along the insulation layers than across them.

Illustrating the air requirements of large turbo-generators, Mr. Lamme said that a 30,000 kw. unit requires about 90,000 cu.ft. (2,500 cu.m.) per minute.

Mr. Williamson illustrated the importance of satisfactory insulation between laminations by pointing out that leakage of eddy currents through a restricted area may seriously overheat sections of the laminations. Inserting paper punchings midway between ventilation ducts is particularly beneficial.

The amount of air required for ventilating large generators was vividly pictured by Mr. Foster, who said that modern units demand an amount of air equal to their weight every forty to sixty minutes. On the average unclarified air for a 30,000-kw. unit carries about 1¼ cu.ft. (35.4 cu.cm.) of dirt per day, which, if deposited on oily surfaces, would soon clog up ducts and possibly be the cause of surface fires later.

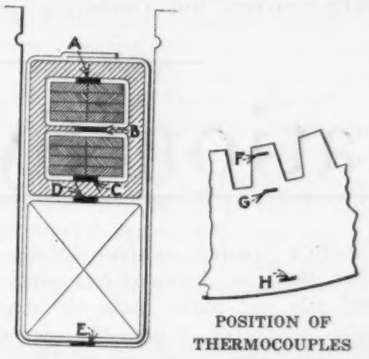
EXPERIENCE WITH TEMPERATURE DETECTORS

Dealing particularly with the maximum temperatures in embedded portions of armature coils, F. D. Newbury and C. J. Fechheimer pointed out that considerable error may result from improper installation of detectors. Even if properly installed between coil sides, the detector does not read the maximum copper temperature. The principal reasons for this are that there is a flow of heat from the adjacent sides of the copper in the upper and lower coils to the slot sides and that there is a difference of temperature between the upper and lower coils. The difference in temperature between the copper in the two coils is due principally to difference in eddy-current loss arising from the cyclic change of leakage flux.

Test data were obtained on a 12,000-kva. alternator and on a model of an armature with thermocouples on the bare copper as well as between coils, and with wide and narrow resistance exploring coils. These indicate that there is a greater difference between the maximum and minimum readings with detectors between coils exposed to the cooling air than with detectors similarly placed but protected from the air, and the difference is smallest with detectors on the bare copper.

Detectors at the bottom of a slot in the 12,000-kva. alternator and under a wedge in a 3,750-kva. turbo-alternator showed (in conjunction with readings on the bare copper) that detectors so placed cannot read the copper temperature nor in any way give an indication of the thermal drop through the insulation. The detector reads the temperature of that part of the iron or wedge with which it is in contact.

Measuring temperatures by detectors in the upper coil is not customary, therefore it would be best to continue with detectors between coils, protecting them from external air currents. The detector reading is then a means of judging the maximum copper temperature and as such may be used for comparison of readings between machines.



POSITION OF THERMOCOUPLES

Mr. Fechheimer referred to investigations which indicated that detectors placed at different positions between coils may vary considerably in their readings and from the true copper temperature, especially when there is a high eddy-current loss in the upper coil.

In considering the temperature problems W. J. Foster said that the first and most fundamental consideration is the relation of the space occupied by the object to the total heat losses to be dissipated. Below a certain value of this constant it is absurd to use ventilation housings, no matter how great the rating of the machine, as such housings have the effect of preventing the natural means of heat dissipation, *viz.*, convection and radiation. Water is an ideal agent for cooling purposes by reason of its high capacity for heat, he pointed out, but it is difficult and almost impossible to use it for removing the heat generated in the rotating element of a generator. There are objections to its use in the stationary element, such as danger from leaks developing in the pipes and condensation on surface of pipes. He advocated conservatism in temperature for both classes of generators, the so-called low-temperature and high-temperature machines.

While the conductivity of insulation is known, that of a composite insulation is indefinite, said Mr. Newbury, so copper temperatures cannot be accurately based on external temperatures but must be actually measured. He favored the rise-in-resistance method becouse of the consistency in readings compared with those of detectors.

B. L. Barnes referred to a case in which lower internal temperatures were obtained by removing the casing of a totally inclosed forced-ventilation generator than with it on. However, the room temperature was increased by its removal.

A. S. Loizeaux expressed the belief that lack of rigid supports for end windings may be responsible for failures attributed to temperature. To assure reliability of service the main leads should be adequately insulated and spaced and current transformers should not be placed in the air-intake ducts where their burning up would endanger the generator.

Mr. Foster pointed out that while increasing copper losses would not affect the present high efficiencies

much, the increased heat generated might introduce a hazard. Regarding Mr. Loizeaux's statements, he contended that to withstand sudden blows end winding braces must be flexible and not rigid. Nevertheless they should be rugged. He also called attention to some unreasonable specifications and urged that requirements be made more specific.

The development of the general formula for the loss ratio in a conductor carrying current when located in any position in a slot with reference to other conductors which carry currents of the same or different phase was outlined by R. E. Gilman. This loss ratio is the ratio of actual alternating-current loss (including the effect of eddy currents) to the loss in the conductor carrying the same effective value of direct current. A series of test results were given where various combinations of strands and groupings were used, and the loss ratio from these results was compared to the calculations from the formulas.

S. L. Henderson presented some practical applications of Gilman's formulas for determining eddy-current losses and showed that the size of conductor which can be provided is limited by total heat losses caused by I^2R loss plus the eddy-current loss. Deeper slots can be used with 25-cycle machines than with 60-cycle units.

Excitation Systems Session

TENDENCY *among central-station engineers toward individual exciters rather than the common-bus method. Direct-connected units used where speed will not make them too expensive. Excitation systems very commonly separated from the drive for auxiliaries, to isolate trouble. Operating men seem to mistrust compound-wound exciters on account of difficulties that have been experienced with operating them in parallel.*

OF THE two common methods of providing excitation, one from a common bus, the other by means of individual exciters, J. W. Parker and A. A. Meyer set forth the advantages of the latter method. First, it does not entail the maintenance of an additional energy system. Second, disturbances in the individual excitation system are limited to a single generator, instead of endangering the power plant. Furthermore, the scheme lends itself well to expansion and increase in station capacity. With the individual exciter scheme the direct connection of the exciter to the main generator shaft gives it the advantage of good speed regulation. There is, however, one objection raised to direct connection—the possible loss of the exciter puts the main unit out of service. This chance, however, may be minimized to a very small hazard, it was said. Control of excitation is also much more simple than if common bus excitation is employed. With individual exciters only a small field rheostat is necessary, whereas in the latter case a large field rheostat is required in addition to the exciter field rheostat. It was also asserted that a direct-connected exciter being driven by a large turbine affords the maximum of economy as well as greater reliability.

EXCITER PRACTICE IN THE NORTHWEST

The automatic regulator, J. D. Ross asserted, is little used in Northwestern plants on account of the complication and tendency to build up voltage on short circuit. However, for the new 15,000-kw. hydro-electric unit being added to the Cedar Falls station of the Seattle municipal system a regulator and an exciter large enough for a 36,000-kw. plant—the full development of the entire station—have been selected, so that only one exciter will be required at a time. This design was preferred to an individual exciter for each generator because of its greater simplicity. Auxiliaries are driven from an auxiliary bus energized by a prime mover and a battery, entirely separate from the exciters, thus assuring a steady voltage for auxiliaries and removing a complication from the exciter system.

Mr. Ross said he did not favor the compound-wound exciter because it tends to pile up the voltage on a short circuit and to give trouble in paralleling. The shunt-wound machine with ample voltage range is ideal, he believed. The trend on the coast is away from small generators of different characteristics to large and uniform generating units. A number of plants are using combined waterwheel and induction-motor drive for at least one of the exciters.

The ideal exciter system for an entirely new plant is one in which each generator has its own shunt-wound exciter and regulator. This allows a new generator to be ordered with its proper exciter regardless of changes in design of machines.

CONTINUITY OF SERVICE THE PRIMARY REQUIREMENT

In laying out excitation systems for central power stations continuity of service is the primary requirement, while first cost and economy in operation are of secondary importance, said H. R. Summerhayes. Reliability depends not only upon exciter design but on method of drive, wiring and connections, method of control and reserve capacity. While the common excitation bus has predominated in American practice for many years, Europe has shown more preference for individual exciters, and America is tending that way.

Of the steam turbines of 7,500 kva. and more sold by one manufacturer during the past five years, about 45 per cent were equipped with direct-connected exciters, and of the hydro-electric generators of 1,000 kva. and more, about 75 per cent had direct-connected exciters and an additional percentage had individual motor-driven exciters.

Mr. Summerhayes held that common excitation plants have the chief advantage of constant bus voltage, permitting floating a storage battery on the exciter bus,

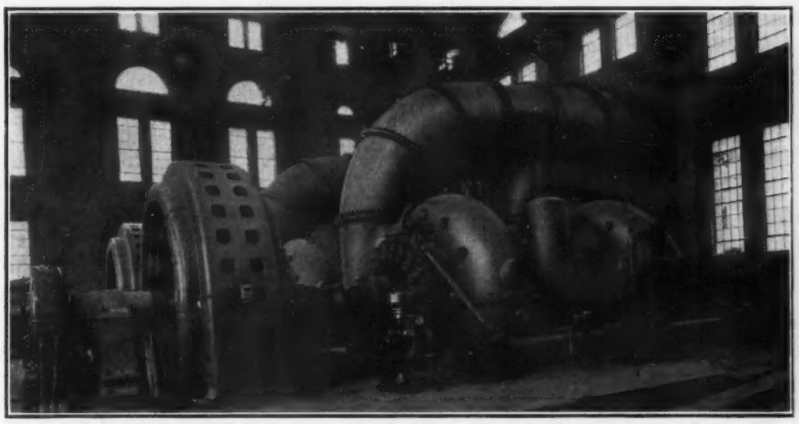
a plan much used in important lighting stations to insure against shutdown due to exciter trouble.

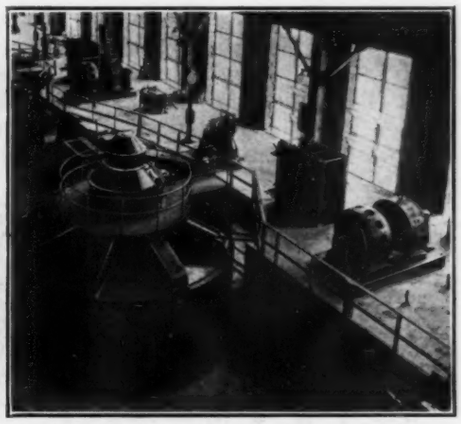
Regarding methods of drive, he said that for large plants direct-connected exciters are most reliable, efficient and less costly whenever speed requirements allow their use. Attention was also called to the fact that field switches should be non-automatic on overload, Exciter breakers should operate automatically on reverse current and field switches automatically only in connection with balanced or reverse-current protective systems which operate the oil circuit breaker in the alternator circuit.

He recommended shunt exciters for individual excitation and for operation in parallel with batteries, but preferred compound exciters for parallel operation without battery on account of the better maintenance of voltage and smaller need for rheostat adjustment.

DEVELOPMENT OF EXCITATION SYSTEMS IN SOUTHERN CALIFORNIA

H. H. Cox and H. Michener explained the practice in excitation for the hydro-electric plants of the Southern California Edison Company.





TWO EXAMPLES OF INDIVIDUAL EXCITERS WHICH ARE BECOMING FAVORED—DIRECT-CONNECTED AND SEPARATE

At the Big Creek plants Nos. 1 and 2, each with two 17,500-kva. generators, there are two 150-kw. exciters respectively, one exciter of each set being also coupled to an induction motor. The exciter fields in station No. 1 are supplied from a motor-generator set consisting of a 250-volt direct-current and a 125-volt direct-current machine connected in series opposition and driven by an alternating-current motor. The 250-volt machine is under control of a standard-range Tirrill regulator controlling it from 125 volts to 250 volts. The resultant voltage, 0 volt to 125 volts, of the two machines is taken to excite the fields of the main exciters, giving them complete range from 0 to maximum. At plant No. 2 the exciters are under control of a broad-range regulator controlling their voltage from residual to maximum.

In the new Kern River No. 3 power plant, with two 17,500-kva. generators, each generator is to be equipped with a direct-connected exciter and there will be one spare one, each of the three exciters being controlled by a separate broad-range voltage regulator. In the plans for the Big Creek power house No. 8, the initial development of which will consist of one 25,000-kva. unit, an exciter will be directly connected to the generator shaft. A spare exciter will be kept at the power house, not connected to any motive power, to replace a burned-out exciter on the generator in case of accident.

Exciters used in connection with automatic regulators were discussed in some detail by C. A. Boddie and F. L. Moon. Where automatic voltage regulators of the Tirrill type are employed a responsive system is necessary to avoid hunting of the regulator. The responsiveness of the system depends chiefly upon the quickness with which the exciter responds to changes in its field resistance and upon the speed with which the alternator field current responds to changes in the exciter voltage. The time rate of change of the voltage of a direct-current machine when its field resistance is altered is proportional to the instantaneous difference between the *IR* drop in the field circuit and the terminal voltage of the machine—that is, the "opening" between the magnetization curve and the volt-ampere characteristic of the shunt field circuit, as measured in volts—and is inversely proportional to the interlinkages of flux and field turns at rated voltage.

Differential series windings are not detrimental to regulator performance, it was held, and in some cases may be of benefit in promoting stability of parallel operation. Cumulative series windings, if they constitute a considerable portion of the total field strength, may seriously impair the quality of regulation obtained. In some cases trouble from polarity reversal of compound-wound machines under abnormal conditions has been experienced. Sufficient cumulative series effect to balance the demagnetizing armature reaction in a non-commutating-pole machine is not only harmless but desirable. It is very necessary where broad range regulating is used, in order to avoid polarity reversal.

R. C. Miner contended that the separate exciter system is relatively simple and inexpensive. Prime-mover-driven exciters should not be used in water-power plants unless they require driving units large enough not to be likely to be shut down because of the presence of trash or similar interference.

F. W. Sims said that shaft-driven exciters and one motor-driven exciter for emergencies make for reliability and have been adopted on all horizontal turbo-units of his company.

E. G. Merrick urged against providing protection from trouble that may occur only 1 per cent of the operating time if these provisions may introduce an operating hazard at other times.

W. F. Dawson favored automatic regulators for small

plants or where load fluctuations are excessive and the use of shunt-wound exciters on account of the difficulties encountered with parallel operation of compound units.

V. Karapetoff referred to a French system of automatic control without use of contactors developed by Blondel. The exciter is like a converter except that it has separate direct-current and alternating-current windings, the latter energized by series transformers in main leads. At low power factor the armature reaction helps the excitation, and it has zero effort at unity power factor. W. J. Foster declared that the General Electric Company had embodied in a machine a principle similar to that described by Professor Karapetoff, but it was found impracticable.

R. E. Doherty pointed out that the responsiveness of an exciter can be improved by increasing the resistance of the field as well as by decreasing the number of field turns. With motor-driven exciters having small responsiveness a drop in speed of 10 per cent may reduce the voltage 50 per cent.

C. J. Fechheimer said that if an alternator on a high-capacity line is operated at zero excitation or for leading power factor the operation may be unstable. He described a type of field compensating winding that can be used to change the saturation curve to a more desirable form.

H. R. Summerhayes emphasized importance of keeping control circuits separate from the excitation system.

C. A. Boddie called attention to the limitations to increasing the field resistance and said that Tirrill regulator contacts should not be worked above 20 amp. to give the best operating results.

Protective Devices Session

TESTS TO *determine possible over-voltage stresses in reactors during short circuits or other abnormal operating conditions are recommended. The use of shunt resistance is advocated as the most effective method of preventing the piling up of destructive voltage stresses at reactors. For the determination of magnetic forces acting on disconnecting switches some convenient formulas are presented. Protection of stations operating in parallel receives particular attention.*

The papers on protection of large systems by reactors presented by R. F. Schuchardt and Dr. C. P. Steinmetz and abstracted quite fully on pages 5 to 8 of the July 3 issue were very cordially received, and several delegates expressed the hope that other companies would take as broad a viewpoint as the Commonwealth Edison Company by making their operating troubles and investigations of the causes and possible remedies available to the Institute in the future. The subject of these papers was discussed by R. E. Doherty, A. E. Bauhan, R. A. Hentz, D. C. Jackson, Philip Torchio, J. R. Lyman, B. G. Jamieson, V. Karapetoff, H. R. Woodrow, E. G. Merrick, J. A. Johnson, H. R. Summerhayes and others.

Mr. Doherty pointed out that even generators in the same station may break synchronism if there is not sufficient reactance between them during a short circuit, or if there is too great a reduction in voltage, since the synchronizing power is proportional to the voltage. To detect hunting between stations, he said, indicating-power-factor meters might be used.

Mr. Bauhan said it is inadvisable to have the emergency steam trips set so low on turbines that the driving power will be shut off during a short circuit.

While bus reactors and generators with fairly high inherent reactance are employed in Philadelphia, chief reliance is placed on feeder reactors, said Mr. Hentz.

Professor Jackson declared that it is startling to hear that large units like the Commonwealth Edison Company's will not drop out of synchronism if the voltage is not reduced more than 50 per cent. If this is true, particular attention must be given to balancing reactance in busbars for current limitation and synchronizing power.

With 5 per cent station-tie reactors and proper relay protection, Mr. Torchio said that the New York Edison Company has experienced dead short circuits on station buses without any failure to clear the trouble. In selecting reactors he pointed out that the problem is to determine what rupturing capacity can reasonably be expected with each oil switch and then to use such reactance in series with them that this limiting value will not be exceeded.

Mr. Lyman referred to some highly satisfactory results which have been obtained with feeder reactors and bus reactors which are interlocked with generator switches so that no more than one reactor is between adjacent units.

Where a company serves consumers demanding 10,000 kw. or more, Mr. Jamieson said there is almost as much need of providing reactor and relay protection as there is in substation feeders.

Referring to the calculation of synchronizing power, Mr. Doherty said that great care must be taken in the assumptions which form the basis of calculations or the results will be far from correct. He then went into some detail to show how this factor must be calculated under different conditions.

Professor Karapetoff urged reviving E. Arnold's energy formulas for calculating stability of oscillating systems, since he considered energy a more secure basis than its components—voltage and current.

Mr. Woodrow favored basing the synchronizing power on the power received by a unit rather than on that transmitted, and said that this factor is greatest when $X = R\sqrt{3}$, but Mr. Doherty declared that this is true only when the bus voltages are constant. Mr. Woodrow favored having comparatively small bus reactance where a network is served—not more than 30 per cent of the total capacity connected to the bus. With radial systems larger bus reactors may be used with satisfaction. He agreed that feeder reactors are very effec-

tive in isolating trouble. Eighty thousand amperes is the ultimate which can be consistently ruptured with present oil switches, he contended; beyond this point the current must be limited.

Where hand control is used for generators or where governors are omitted, as in automatic plants to increase simplicity, the difficulties resulting from short circuits may be aggravated, Mr. Merrick declared.

In hydraulic plants where the driving power of the generators is not shut off immediately after a short circuit by the governors and where the governors themselves may oscillate, forced vibrations may be set up, Mr. Johnson said, which will sustain hunting and eventually pull the machines out of synchronism.

Professor Jackson declared that it is the quadrature current and not the I^2R loss that tends to pull together machines which are out of place. Since the energy equations developed for studying mechanical oscillations do not provide for the complexities occurring in electrical systems, he declared that they would not be so suitable as equations based on voltages and currents. Mr. Doherty concurred in this view.

Mr. Summerhayes pointed out that Dr. Steinmetz's paper gives information which can be used to determine the size of breaker to use and the time setting to select after the protective reactance has been chosen which will prevent machines pulling out of step.

VOLTAGE STRESSES IN REACTORS IN SERVICE

A large number of test cases have been made by F. H. Kierstead and Royal Meeker by means of a 10,000-kw. generator short-circuited through reactors, and it was impossible to observe the presence of high-voltage stresses in the reactors by oscillographic means. Attention was called to the fact, however, that reactors in service may have greater voltage stresses in them than those caused by short-circuit tests. They may be subjected (1) to lighting impulses or (2) to high voltages due to reasonance.

Voltage stresses at instant of short circuit may appear as steep waves produced by the sudden drop in voltage caused by a short circuit. A resistance shunting an inductance reduces the voltage stresses caused by steep waves, however.

At the instant of interruption of a short-circuit current it was shown that, in the case of direct current, the voltage obtained across the reactor is independent of the applied voltage and depends on the current interrupted and the rate at which it is interrupted. In the case of alternating current, however, with commercial switches the voltage across a reactor is in general independent of the current interrupted and depends on the impressed voltage. It will be approximately equal to double the impressed voltage. If, however, the circuit is opened by a switch so quick-acting that the current is interrupted before it can reach its zero value in accordance with its normal curve, then the voltage will depend upon the current interrupted and the rate at which it is interrupted.

It was also shown that impulse waves may cause non-uniform distribution of the stresses in a reactor. Resistance connected to the reactor winding, however, effects a reduction of these voltage stresses. Extra spacing of the end turns and end layers of the reactor winding cause greater concentration of the voltage stresses on the extra space parts.

In considering the paper by Messrs. Kierstead and Meeker, J. F. Peters did not think the conditions selected for test were representative of practical cases. He said that where the tests showed shunted resistance reduced the voltage across the reactor, the remainder of the impressed voltage was developed at the apparatus to be protected. This view was also shared by A. Nyman, J. Slepian and C. L. Fortescue, who said that protecting a protecting device was introducing an unjustified complication. Dr. A. E. Kennelly said that the shunting resistance was designed for high-frequency disturbances such as lightning, and Philip Torchio added that the energy of the high-frequency disturbance should be absorbed in the resistance. He did not believe arcing over at the end turns of the reactance has caused trouble.

Regarding voltages developed across the end turns of a reactor, H. R. Woodrow showed how increasing the insulation but not the spacing increased the capacity and lessened the accumulation of voltage at the end turns. He also pointed out that the use of resistance should be fully justified if this added complication was to be introduced.

MAGNETIC FORCE ON DISCONNECTING SWITCHES

The calculation of the forces acting on disconnecting switches was worked out by H. B. Dwight. The results of his analysis may be expressed in the two following equations:

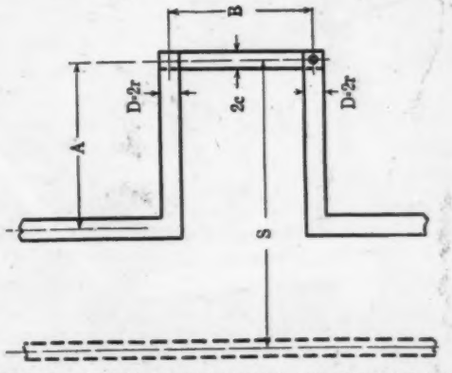
The total force at the break jaw when A is greater than B (see figure) is:

$$I^2/4.45 \times 10^7[2.3 \log_{10}(B/r) + \tfrac{1}{3} - B/A + \tfrac{1}{4}B^2/A^2 + 3/20r^2/A^2 - 1/32B^4/A^4 + B/S] \text{ lb.}$$

When A is less than B the force is

$$I^2/4.45 \times 10^7[2.3 \log_{10}(2A/r)\tfrac{3}{4} - \tfrac{1}{2}A/B - \tfrac{1}{4}C^{2*} + 3/20r^2/A^2 + 1/24A^2/B^2 + 1/24AC^2/B^3 + B/S] \text{ lb.}$$

The letters used in these equations are shown in the accompanying figure, and the writer gave curves for



TYPICAL LAYOUT OF DISCONNECTING SWITCH AND RETURN CIRCUIT

common ratios between these dimensions for their determination and insertion in the equations.

Prof. V. Karapetoff asserted that the problem undertaken by Mr. Dwight could have been much more simply solved from the energy equation. He stated that the force acting on the disconnecting switch should be represented by the simple equation

$$F = \tfrac{1}{2}I^2(dL/ds),$$

where L is the inductance of the circuit loop, s is the displacement of the switch blade and I is the current.

The method advocated by Professor Karapetoff was also favored by A. Nyman, who said he had used it in calculating forces acting on oil-switch contacts and rods. E. G. Merrick said that the peak value of current should be used in the force equation.

Electric Welding Session

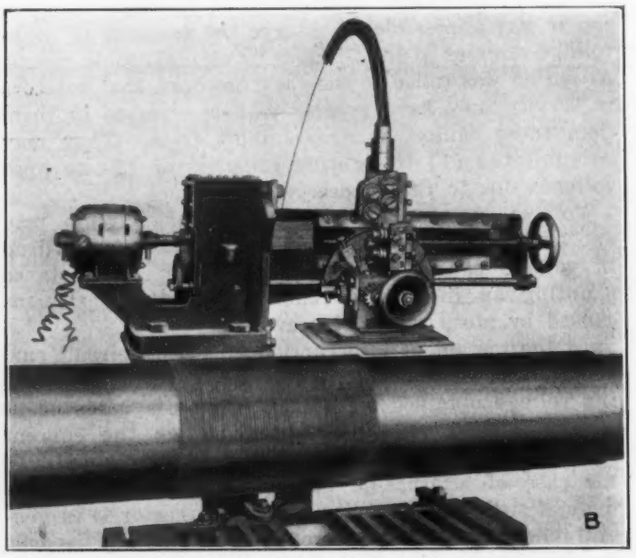
SIMPLICITY *and reliability appear to be the chief requirements of electric welding devices. Because of the comparatively few trained welders it is desirable to make the welding outfits as automatic as possible, particularly in current control with changing arc length. This is being accomplished by the use of generators in which the desirable characteristics are inherent*

AN INTERCONNECTED constant-current, variable-voltage, direct-current generator and exciter which has been developed recently was described by A. M. Candy. The generator is a commutating-pole machine provided with a series-field winding, a shunt-field winding separately excited continually by means of a small exciter coupled to the generator shaft, and a second shunt-field winding connected to both the generator terminals and the exciter terminals, so that under open-circuit and normal welding conditions it is self-excited by the generator voltage, whereas under short-circuited conditions it is excited in the opposite direction by current from the exciter terminals. With this machine drooping characteristics are obtained such that the short-circuit current is substantially the same as the normal welding current.

Within the last year electro-percussive arc welding equipment has been developed, said D. F. Miner, which successfully welds stock up to ½ in. (1.27 cm.) diameter, and larger sizes will apparently offer no difficulty. In this device the stored electromagnetic energy replaces electrostatic energy. Establishment of a strong direct-current field in a reactance coil with a primary and secondary winding is followed by rupture of the primary current with the secondary circuit closed. Transfer of energy of the collapsing field to the secondary results, and a subsequent separation of electrodes in this circuit establishes an intense arc. When the surfaces of the electrodes (pieces to be welded) are sufficiently melted a hammer forges the parts together. The total time of these operations is of the order of one-tenth second.

Welding machines of the single-operator type were described by W. A. Turbayne, one a direct-current generator separately driven by any form of motor and the other a direct-current converter fed from 160-volt to 125-volt direct-current source. The generator is a self-exciting cumulative compound-wound machine, and current regulation is effected solely by the reaction of the armature current upon the field flux. The converter combines the functions of a shunt-wound motor and a variable-voltage generator.

A new type of arc-welding generator was described by S. R. Bergman and R. L. Unland which inherently possesses the electrical characteristics desirable for



CONSTANT-CURRENT WELDER; DEVICE FOR FEEDING WELDING ELECTRODE AND SAMPLES WELDED BY ELECTRO-PERCUSSIVE METHOD

1. ¼-in. copper rod welded to steel disk.
2. ¼-in. steel rod welded to steel disk and tested in bending without failure.
3. ¼-in. copper-copper weld bent sharply without failure.
4. Nickel-steel valve head welded to cold-rolled steel stem. Failed in bending outside weld.
5. T-weld of cold-rolled steel.
6. Cold-rolled steel rod and disk polished.
7. ¼-in. drill lengthened with low carbon stock.
8. Nickel-steel head to valve stem.
9. ¼-in. hollow steel rod welded to steel plate.

single-operator arc-welding generators. A drooping volt-ampere characteristic, which is advantageous for successful electric arc welding, is obtained by what is known as a dual magnetic circuit.

The design consists of a four-pole field structure and an armature wound for the two poles. The field poles are paired to give two adjacent poles of each polarity. While slow regulation and the lag between the sudden variation in the arc and the corrective electrical or magnetic adjustment in the machine make some machines unsuitable for welding, the regulation of this generator is produced chiefly by the armature itself so no such trouble is experienced.

A new development was also described for automatically feeding a barb-wire electrode into the welding arc at the exact rate required to maintain constant electrical conditions in the arc. This device consists of a small direct-current motor geared to feed rolls and electrically connected across the welding arc through control, with the result that the speed of the motor and consequently the rate at which the wire is fed into the arc vary with the voltage across the arc. The result is that practically constant voltage is maintained across the arc and therefore the current will be constant.

In the results of a large number of experiments, K. L. Hansen said, he had found nothing to support the contention that the constant-arc wattage characteristic is particularly suited for arc welding. Some persons think it is desirable that the starting current should be larger than the working current in order to heat the point of contact rapidly. The speaker's experience, on the contrary, had been that a large current at the instant of striking the arc merely increases the tendency of the electrode to freeze or stick. While a large reactance makes it easy to strike and maintain the arc, it seems that the penetration is seriously affected.

With a long arc a high-carbon wire loses most of its carbon while going through the arc, said Alexander Churchward, but not so with a normal arc. A system was therefore developed whereby a long arc cannot be drawn, 16 volts to 19 volts being used for the normal arc. This was obtained without more than 5 per cent fluctuations in the arc current by using a carbon-pile in series with a 35-volt generator.

C. J. Holslag refuted a statement that bare-wire electrodes cannot be used with alternating-current welders, saying that several have been in satisfactory operation which have used nothing but bare wire. Regarding relative efficiencies of direct-current and alternating-current welders, he said the ratio is about 170 to 156.

S. R. Bergman referred to a tapering slotted type of air gap used in welding transformers which is particularly suitable for a wide range of currents.

D. F. Miner declared that the energy which is required for steel-to-steel welds is less than is required for copper-to-copper.

R. E. Kinkead pointed out that long-arc welders can have arc lengthened more rapidly than short-arc machines without breaking. He called attention to the need of a uniform method of rating welders, suggesting pounds of metal deposited per hour, although this depends on human factor.

P. O. Noble pointed out that the penetration of a weld depends upon the current and relative rate of movement of the parent metal with respect to the electrode and contended that direct-current welding gives the greatest penetration.

Power Factor Session

THERE ARE MANY *developments in types of industrial power loads which are attended by unbalanced conditions between the phases, unbalanced as to amount of loads and as to phase relations between current and voltage. In such cases the numerical value of power factor may vary widely with different definitions. On account of the importance of this development a joint committee representing both the N. E. L. A. and the A. I. E. E. has been deliberating on the definition and measurement of power-factor in polyphase circuits*

TWO definitions covering different forms of power factor in polyphase circuit have been arrived at by a joint committee of the N. E. L. A. and A. I. E. E., together with some suggestions as to proper qualifying terms to apply to each definition. These definitions follow: (1)—Power factor in a polyphase circuit is the ratio of the total watts to the arithmetical sum of the volt-amperes in the several phases, each measured to a non-inductive neutral point. This definition may be otherwise expressed as the weighted mean of the individual power factor in the phases (weighted according to the volt-amperes in each phase). (2)—Power factor in a polyphase circuit is the ratio of the total watts to the vector sum of the volt-amperes in the several phases.

It was urged by H. L. Walau that as technicians the membership would probably agree that definition 2, which is mathematically accurate, should be adopted to represent that quantity which is referred to today as power factor. As commercial engineers, however, it should be recognized that definition 1 has a broad field of usefulness when applied to unbalanced circuits. He called attention to the loads consisting of welders having very poor power factor (20 to 40 per cent), single-phase arc furnaces of relatively better power factor (35 to 70 per cent) and in some cases single-phase railway loads also of poor characteristics. Increased costs of supply result from such conditions. Either the rates in industrial schedules should reflect the added costs and they should be proportioned over all consumers alike, or some means of penalizing the consumer causing the added burden must be incorporated therein.

In order to get at all the results of the application of definition 1, Philip Torchio submitted the following

table giving comparative load capacities of electrical equipment required for generating and transmitting a unit amount of power under different conditions of unbalancing, all giving the same average value of power factor by definition 1.

Power Factor by Definition 1, Per Cent	Capacity of Electrical Equipment Required for Generating and Transmitting 1,000 Kw. of Balanced Load, 33-33-33 Per Cent	Unbalanced Load, 27-33-40 Per Cent	Unbalanced Load, (Single-Phase) 100-0-0 Per Cent
100-99.5	1,000 kva.	1,100 kva.	.....
86.6	1,150 kva.	1,250 kva.	1,740 kva.
75.0	1,330 kva.	1,425 kva.	2,000 kva.
50.0	2,000 kva.	2,175 kva.	3,000 kva.

This comparison shows that with apparently the same value of polyphase power factor, the capacity of electrical equipment required for generating and transmitting the same amount of power varies as much as one to one and one-half.

Improvement Depends Upon Accurate Metering

Within the last two years practically all power companies have come to the conclusion they must penalize for lower power factor, according to Will Brown. The greatest obstacle is the chaotic condition of metering. He urged that the manufacturers and the central stations co-operate for the solution of the metering problem.

Symmetrical Co-ordinates in Power-Factor Representation

The paper by C. L. Fortescue was a more complete presentation of the subject of power representation by means of symmetrical co-ordinates, which was outlined by him before the A. I. E. E. in 1918 and resulted in the following definitions: Power factor shall be determined from measurements of three-phase power by means of two or more wattmeters connected in the usual manner and from reactive power measured by a reactive power meter with the same connections as those used in measuring the true power. If P be the true power and Q the reactive power, power factor $= P/(\sqrt{P^2 + Q^2})$. The ratio of one unit of the negative phase sequence component of a quantity to the corresponding unit of its positive phase sequence component is defined as the unbalance factor of the quantity under consideration. Usually the ratio of the magnitudes only need be considered.

In conclusion Mr. Fortescue stated that the power factor defines, is easily measured and completely determines all the quantities it is necessary to know in order to make proper charges for energy.

Measurement of Power Factor in Unbalanced Polyphase Circuits

It was shown by R. D. Evans that an unbalanced system may be readily resolved into its two component balanced systems and that each may be readily measured.

Definition 2 was advocated by F. C. Holtz, who also outlined a method of measuring power factor in polyphase unbalanced circuits, in accordance with this definition.

W. H. Pratt summarized his opinions of the two definitions by saying that definition 1 most nearly extends the idea of the single-phase definition to polyphase conditions and results in a quantity that is well suited for the evaluation of volt-amperes in the lines. Definition 2 gives a quantity that has wide applicability and, when the currents and voltages do not depart greatly from sine waves, is easily measured. It is, however, a characteristic of the load as a whole and is the result of the vector addition of its parts. It merits a distinctive name of its own. The analysis by symmetrical components suggests a balance factor, which, if readily measured, could be very useful. The resulting power factor is equivalent to definition 2. Finally, there is no one factor that can describe all that it may be necessary to know under the general head of power factor, using the word in the very general sense that has been current up to now.

Definitions proposed by Carl J. Fechheimer are given as follows: Power factor is the ratio of the true watts to the volt-amperes in the balanced positive sequence systems of volts and amperes. The unbalance factor is the ratio of the negative sequence amperes to the positive sequence amperes.

For technical purposes it is highly desirable to separate the effects of phase displacement, unbalance and wave form, since the causes and remedies for each are quite distinct, pointed out Francis B. Silsbee. This can readily be accomplished by defining one or more additional quantities so that one quantity (such for example as "vector power factor") indicates the phase displacement as distinct from unbalance, and a second quantity (such as balance factor) shows the symmetry of the loading as distinct from any general phase shift.

It was urged by P. M. Lincoln that definition 2 gives results which are entirely independent of the question of unbalance. He strongly recommended that definition 2 be the one adopted for polyphase power factor.

F. V. Magalhaes emphasized the fact that manufacturers and central stations are seriously in need of a standard definition of polyphase power factor, which would most properly eminate from the A. I. E. E.

V. Karapetoff pointed out that there is no such thing as power factor of a polyphase circuit, therefore an attempt to define it should not be made. For practical as well as theoretical purposes it would be better to measure the reactive power by wattmeters with the voltage elements displaced 90 deg. The ratio of the reactive power-to-power would then be the idle power factor and would give all conditions required. Central-station customers could be told that it is in their power to reduce this factor and secure a better rate.

C. J. Fechheimer agreed with Professor Karapetoff and said power factor and unbalance factor should not be combined in one factor.

Dr. A. E. Kennelly urged an agreement regarding the definition of power factor and method of measuring. When a three-phase system is balanced and there are no harmonics, power factor may be readily measured by a polyphase wattmeter and reactive wattmeter. The effect of harmonics can be neglected for all except precision results. Dr. Kennelly recommended definition No. 2, presented by the joint committee. (See last issue.)

Philip Torchio said that it is unnecessary to allow for load unbalance in a definition of power factor since it can better be taken into account separately. A motion was carried that it was the consensus of opinion at the meeting that polyphase power factor be defined as the ratio derived from the active power and reactive power. The committee on this subject was instructed to proceed to devise definitions on the basis of the discussion at this meeting, to be acted upon later.

Increasing Oil-Circuit-Breaker Capacities

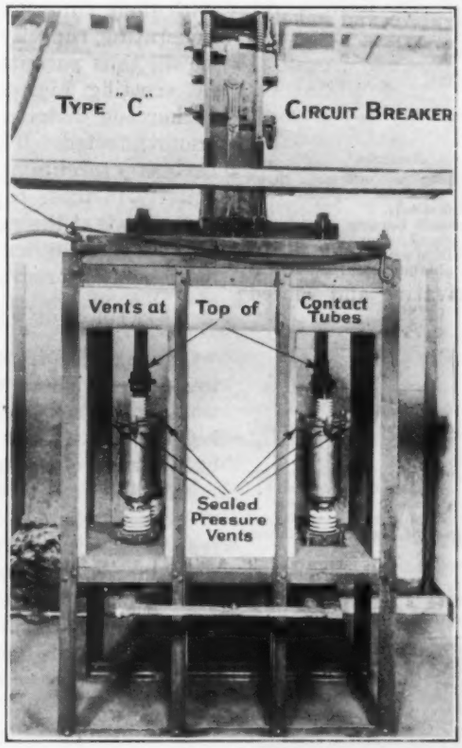
A Standard Oil Breaker, Equipped with Pressure Vents, Hollow Contact Rods and an Improved Liquid for Quenching the Arc, Showed Greatly Increased Rupturing Capacity Under Actual Tests

By C. J. HEJDA
Testing Engineer Commonwealth Edison Company

AS CENTRAL-STATION systems continue to grow new problems arise concerning switching unit performance under extreme conditions. These switches at the time of their installation proved quite adequate, with the limited size of the system, but later became inadequate in rupturing capacity because of the increased volume of energy available at the switch at the time of trouble.

In the study of this problem tests were recently made at a substation of one of the largest central-station companies, on a "type C" oil circuit breaker, with a view of determining the extent to which the rupturing capacity at short circuit of switching units in present use may be increased in order to avoid, if possible, the expense of replacing them by units of larger capacity or of a different type. In some instances, moreover, the greater space required by the new units is not available.

A 300-amp. "type C" oil breaker was connected to a three-conductor 300,000-circ.mil underground cable 20,000 ft. (6,100 m.) long and short-circuited between two phases. The energy was supplied from a 12,000-volt, 20,000-kva. turbo-generator, operated at a normal frequency of 60 cycles. The tests were first started at reduced voltage, and on each successive short circuit the voltage was increased in small steps until the oil breaker began to show stress. Under normal conditions—that is, with the usual mineral oil in the wells and no modifications—the breaker began to show considerable distress on a 10,000-volt short circuit. Contacts were badly burned, fire and burning vapor were expelled from the wells to a height of 2 ft. or 3 ft. (60 cm. to 90 cm.), and insulators at the top of the wells were broken from the pressure caused by the vapor.



VIEW OF CIRCUIT BREAKER USED IN TESTS. NOTE SEALED PRESSURE VENTS AT TOP

The breaker was then filled with "S. & C. Excello Liquid" in place of transil oil and tests were repeated. Under these conditions the breaker showed a marked improvement in performance. While the porcelain insulators again broke during the opening under short circuit, no flames were expelled and the contacts gave little evidence of burning.

The breaker was then equipped with a venting arrangement, developed particularly for use with "S. & C. Excello Liquid." Instead of the usual solid contact rods, hollow brass or copper tubes were used with a venting arrangement at the upper end. These vents are normally closed by a disk or sphere held in place by gravity and opened with pressure in wells. In the ordinary oil breaker using solid rods the arc formed at the contacts generates gases, which force the oil away from the arc, thus retarding the action of the liquid in quenching the arc. With the use of the tubular rods the quenching action is more effective, in that the gas pressure created in the wells by the arc at the contacts forces the liquid across the arc into the tube, where the gases are free to escape through the top vents. The wells were filled with the "S. & C. Excello Liquid" to the usual level and the tests again repeated. One test was made at 10,000 volts and two at a normal operating pressure of 12,000 volts. On all these tests the circuit breaker opened the short circuit successfully without showing any distress.

To determine the effectiveness of the hollow rod venting, three soldered-disk pressure vents were mounted on each well and were sealed to open at a pressure of approximately 150 lb. (70 kg.). On each of the above tests only one of the twelve pressure vents opened, which indicates that the pressure in the wells was not much in excess of 150 lb. (70 kg.) and proves the effectiveness of venting in the hollow rods.

The efficiency of the "S. & C. Excello Liquid," combined with the venting arrangement, is also shown by the small amount of burning or fusing at the end of the contact tubes. The tubes in each of the tests showed only about $\frac{1}{8}$ in. (3.2 mm.) of the circumference burned away, although the thickness of the tube wall was only $\frac{1}{4}$ in. (3.2 mm.). This amount of burning is much less than was obtained with oil in the wells and solid rods even at the lower short-circuit voltages.

The accompanying photograph shows the circuit breaker which was used on the tests. The sealed pressure vents are plainly visible in the illustration at the top of the wells.

The tabulations on page 68 summarize the results obtained in the tests on the circuit breaker under the various modified conditions.

The fluid which is referred to in this article as improving the rating of the oil switch under test is a chlorine derivative, but is much less volatile than carbon tetrachloride, which has already been tried as a substitute for switch oil.

With usual transil oil in wells and no modifications on switch:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
1	5,000	900	4,500	No fire. No oil expelled from wells. Contacts burned considerably at tips.
2	7,900	1,650	13,000	Considerable oil expelled from both compartments. Contacts burned considerably. No flames.
3	10,000	2,220	22,200	Flames shot up along rods in both compartments to a height of 3 ft. Top insulators on two out of four wells broke. Contacts badly burned at tips. About one-third of oil expelled from wells. Oil badly carbonized.

With the low-volatile chlorine derivative in place of usual transil oil—other conditions the same:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
4	10,000	2,100	21,000	About one-quarter to one-third of liquid expelled from wells. No flames. Three insulators out of four broke as in test No. 3. No appreciable burning of contacts.

With the low-volatile chlorine derivative and bakelite disks at the top of wells in place of porcelain insulators to guide the rods:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
5	8,000	1,860	15,000	Slight burning of contacts. Small amount of liquid expelled from wells around rods.
6	10,000	1,800	18,000	No appreciable burning of rod contacts. Small amount of liquid expelled from wells.
7	10,000	2,100	.....	No appreciable burning of contacts.

With the low-volatile chlorine derivative and vented tube contacts in place of solid rods:

Test No.	Terminal Pressure of Generator, Volts	Short-Circuit Current, Amp.	Kva. Ruptured (Single-Phase)	Remarks
8	10,000	2,100	21,000	About $\frac{1}{16}$ in. of tube contact burned. From $\frac{1}{2}$ in. to $2\frac{1}{2}$ in. of liquid expelled from wells.
9	12,070	2,520	30,400	Contact tubes burned off $\frac{1}{16}$ in. to $\frac{1}{4}$ in. About $1\frac{1}{4}$ in. to $2\frac{1}{2}$ in. liquid expelled from wells.
10	12,100	2,580	31,200	Very slight burning of contact tubes. No appreciable amount of liquid lost.

Park Lighting with Flood Lamps

IN ORDER to minimize shadows there has been installed in the Syracuse (N. Y.) park system a system of flood lighting which is somewhat novel for this kind of work. Ordinarily parks have only a few low-power lamps which dimly light some of the paths. In four of the Syracuse parks are 144 Western Electric 1,000-volt floodlamps.

Re-establishing Electric Service in France

Chamber of Deputies Adopts a Measure Providing State Aid for High-Tension Distribution of Energy in Devasted Areas Over a Distance of 1,500 Km.

NOT very long since *Le Génie Civil* contained an account, by G. Tochon, of a law adopted by the French Chamber of Deputies, and at the time the article was published awaiting acceptance by the Senate, which is of more than national interest. It concerns the speedy resumption of electrical service in those parts of France which were overrun by the invaders and suffered the destruction of their electrical power houses and transmission lines. Without waiting for the effects of a more general law previously introduced and applying to the whole of France, the act now proposed is intended to meet the immediate needs of the devastated regions by reducing the number of central stations as compared with their number before the war, by augmenting their generating capacity and installing identical machinery in all, thus permitting their operation in parallel, and by erecting high-tension lines tying the stations together and distributing the energy throughout the districts affected. The execution of this program is a necessary preliminary to the resumption of industrial activity in those regions, and it will not meet with the obstacles that the existence of power houses in full operation will, in other parts of the nation, impose to the more general program.

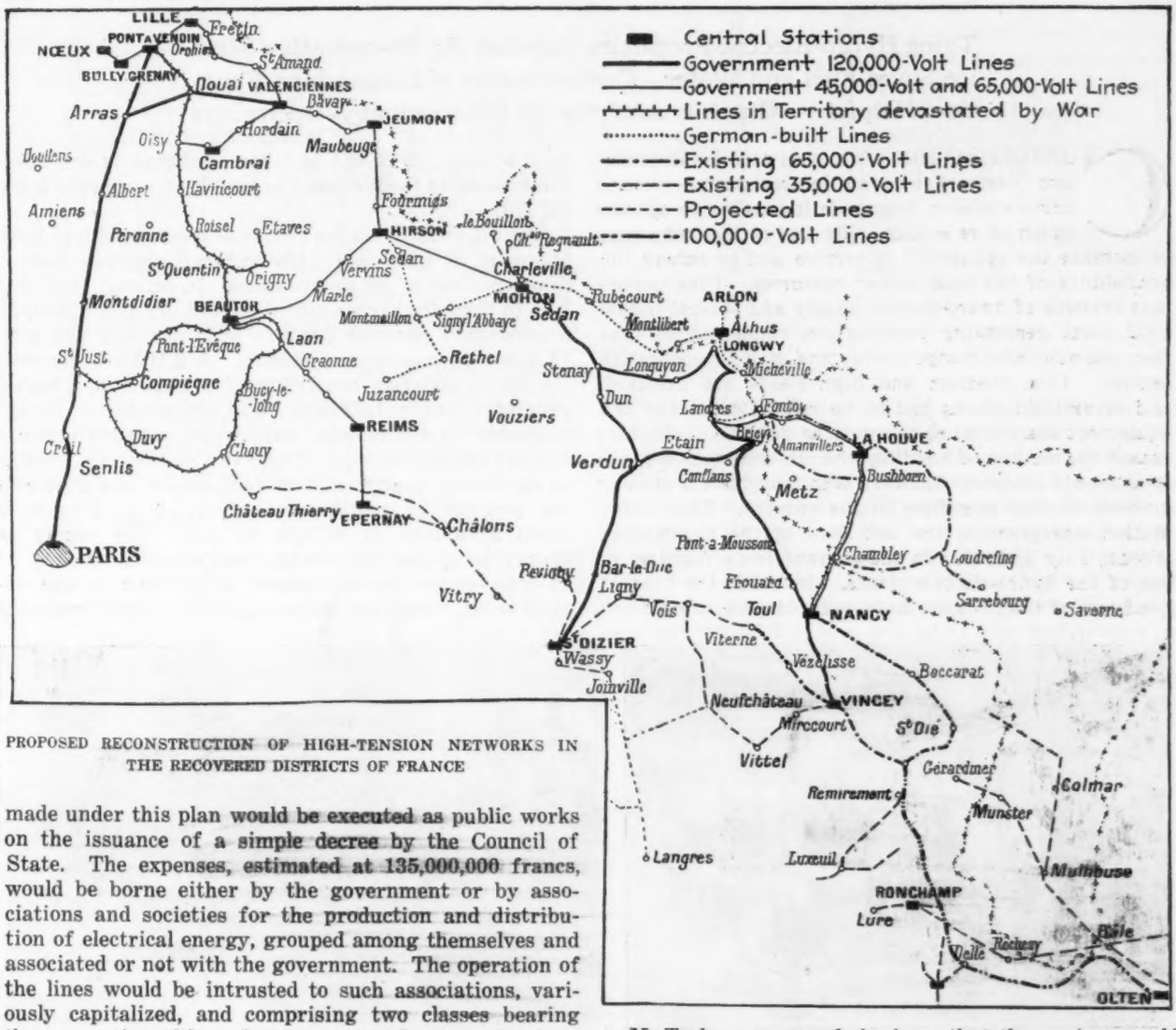
FEATURES OF FRENCH GOVERNMENT'S PROPOSAL

The methods of war followed by the Germans wrought the destruction in part or whole of many central stations and transmission lines. Against this tremendous loss can be set the acquisition of a few power houses built by the foe for military purposes, notably an unfinished edifice at Hirson, near Sedan. It is imperative to repair what is reparable, to reassemble scattered fragments—in short, to reorganize the entire production and transmission of energy. Rather than leave this great work to the caprice of individuals or companies, the French Government has thought it right to draw up a program to which all operators will be obliged to conform. The main features of this program are these:

To make possible the restoration of central power houses the government will advance to the operators part of the indemnities to which their loss by the war entitles them on condition that they devote these sums to the purchase, under the control of the government, of electrical machinery and equipment. The government will at its own expense finish the German-built central station at Hirson.

High-tension lines (45,000 volts) are to be erected from Lille to Paris and from Saint-Dizier to Chambley, in Lorraine, thus extending at each end beyond the devastated region, the total length reaching 1,500 km. (935 miles). This program of construction will, for financial reasons, be divided into two parts, according to the degree of urgency, the branch networks into the devastated districts being constructed first and a double line connecting these networks with the Parisian region, by way of Arras, Albert, Montdidier and Creil, afterward.

The projects for electrical central-station installation-



PROPOSED RECONSTRUCTION OF HIGH-TENSION NETWORKS IN THE RECOVERED DISTRICTS OF FRANCE

made under this plan would be executed as public works on the issuance of a simple decree by the Council of State. The expenses, estimated at 135,000,000 francs, would be borne either by the government or by associations and societies for the production and distribution of electrical energy, grouped among themselves and associated or not with the government. The operation of the lines would be intrusted to such associations, variously capitalized, and comprising two classes bearing the respective titles of managers and concessionaires. The first class would put into effect, under the control of the State, all the acts of administration involving the receipts and expenses of operation, paying to the State a rent equivalent to interest and amortization at 6 per cent on the capital first advanced, paying on the capital invested by the managing association a rate equal to the highest average rate of French *rentes* plus two points, and dividing any excess in the proportion of 50 per cent to the State and 50 per cent to the managing company. The second class would work under similar financial arrangements, but the exploitation of the network, or that portion of it constituting the concession, would be under the direct control of the State. The government authorities would choose one or the other of these alternative methods of operation in accordance with the public interests.

The regulations made by operating associations would be subject to the approval of the government, and government representatives would sit on the administrative councils. The president of an association would in every case be chosen by the Minister of Public Works. The official tariff of charges, in the case of operation by concessionaires, or a special agreement, in case of operation by managers, would fix the division of the charges and the profits. It is hoped the expenses of the undertaking will be in part met by the receipts.

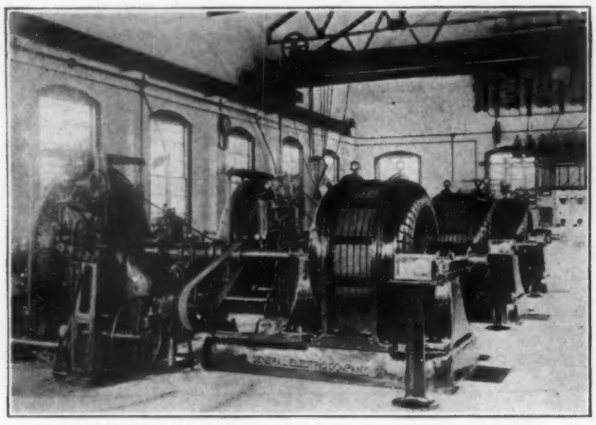
M. Tochon expressed the hope that the project would speedily become a law by the acquiescence of the Senate; for, though it has been found possible to begin the work under the authority of previous legislation, it has proved difficult, in the absence of a declaration of public utility, to vanquish the resistance of landowners who refuse to permit the erection of towers on their property. The projected law, he said, would mark the first attempt at a methodical organization of the distribution of electrical energy in France.

IF EVER *there was a time when the country in general believed in the research being done in colleges, it is now. This sentiment is based upon the work done by scientific men in the war. There is a demand for research men in connection with all big corporations. They go to the universities for their men, and this is proof in itself that the universities provide their students with the proper methods of research. Notable fields where scientific research has been the underlying foundation are sound ranging, the detection of submarines by sound, and a complete revision of the whole method of firing projectiles. This was done by men who had never studied these things, but who were familiar with the mathematical and physical principles that lie at the base of them.*—PROF. L. P. EISENHART *of Princeton University.*

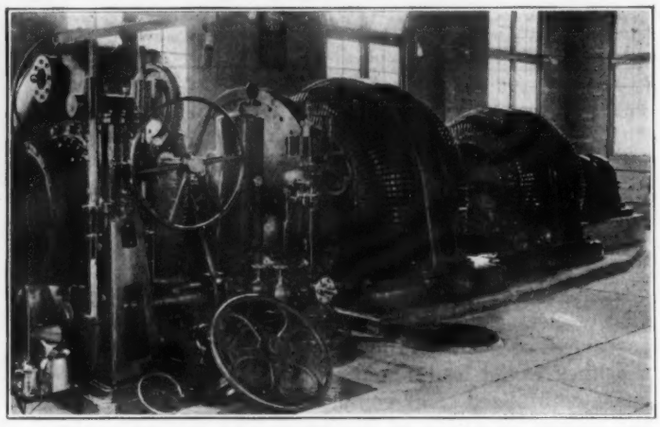
Interconnection in Southern Vermont—II

Tying Hydro-Electric Properties Together for Co-operative Service Saves Fuel and Water—Centralization of Dispatching Function Helpful — Graphic Analysis of Intercompany Operations

CONSOLIDATION of isolated utilities in southern Vermont into an interconnected electric service system has made it possible to operate much more economically and at the same time to increase the reliability of service and to extend the availability of the total power resources. Five important systems of hydro-electric supply and several industrial plant generating stations are connected so that they can now interchange energy and give a co-operative service. Low, medium and high heads are involved, and several old plants had to be rehabilitated and the equipment standardized as much as possible. For this reason the method of handling the interconnection problems should interest engineers who may have a similar problem to face elsewhere in the country. This information was given in the last issue of the ELECTRICAL WORLD, July 3, 1920. In the current issue features of one of the hydro-electric plants, which has the highest head east of the Rockies, are presented, and information is given regarding future system developments expected, nature of load in Vermont, and some of the operating practices on this interconnected system.



Vermont Hydro-Electric Corporation



Hortonia Power Company, Lake Dunmore

INTERIOR OF TWO OF THE SOUTHERN VERMONT GENERATING STATIONS

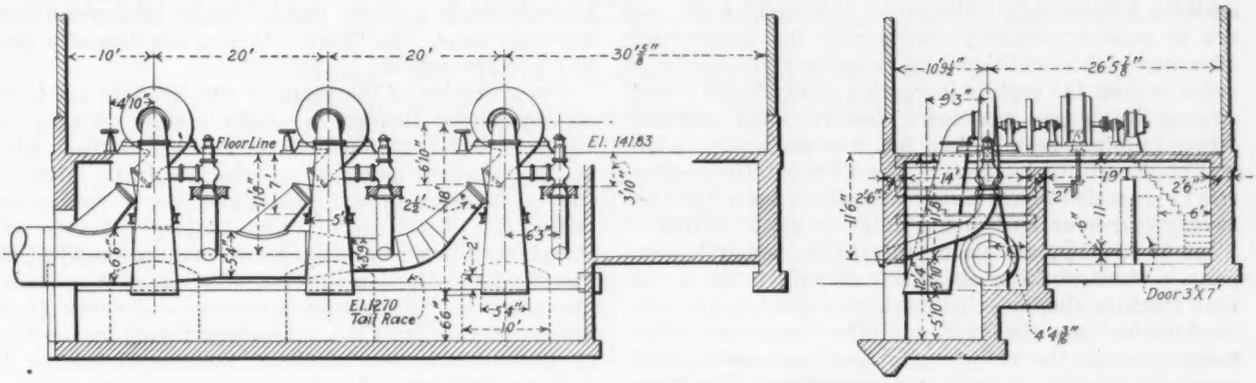
HIGHEST HEAD PLANT EAST OF ROCKIES

Of the eight active plants of the Hortonia company, the most noted from the engineering standpoint is the Silver Lake station. Containing a single unit of 2,260 kw. rating, divided into two generating sets of 25 cycles and 60 cycles driven from a common waterwheel, this station operates under the highest known head east of the Rocky Mountains, 675 ft. (206 m.). The Silver Lake station was built in 1917 and is located in the town of Salisbury, on the shore of Lake Dunmore. It utilizes the waters of Silver Lake and two nearby streams. Silver Lake lies 700 ft. (214 m.) higher than Lake Dunmore, and at its outlet a concrete dam has been built, raising the level of Silver Lake 15 ft. (4.6 m.), and impounding about 287,000,000 cu.ft. (8,140,000 cu.m.) of water. From the intake a 5-ft. (1.5-m.) wood-stave pipe is carried for 3,000 ft. (915 m.) to a 12-ft. (3.7-m.) diameter by a 90-ft. (27-m) high surge tank. From the tank a 36-in. (91.5-m.) lock-bar steel pipe is run down the hillside to the station, the length of run being 2,300 ft. (701 m.).

The tailwater from the station is discharged into Lake Dunmore, a 1,200-acre (486-hectare) reservoir with a drainage area of 30 square miles (76 sq.km.), and this lake in turn discharges into the Salisbury plant through a wood-stave penstock 2,800 ft. (855 m.) long and 5 ft. (1.5 m.) in maximum diameter. A 2,100-kw. generating set is installed, consisting of a 1,625-kva., 25-cycle generator and a 1,000-kva., 60-cycle generator direct-connected to a horizontal waterwheel operated under a head of 178 ft. (54 m.). These two stations are similar in delivering energy at two frequencies and illustrate the practice of reutilization of water so frequently taken advantage of in this district. The supply of energy to an electric railway load required the use of 25-cycle generating equipment in addition to the 60-cycle outfit, rotary converters operated at that frequency furnishing direct current for traction service. The Hortonia company also supplies 25-cycle energy to an important industrial load in New York State, to be mentioned later, and the transmission line of the company running westward from Lake Dunmore to Lake Champlain is operated at this frequency.

In eastern Vermont the Hortonia company interests operate a group of locally interconnected stations, which, with industrial plant generating capacity tied into the system, will add about 1,200 kw. in hydro-electric energy to the resources of the western lines and plants when a 44,000-volt line is constructed from the Pike Hill copper mines to Bethel. The stations in this eastern network range in hydro-electric capacity from 160 kw. to 500 kw. and are interconnected by 13,200-volt lines.

At Port Henry, N. Y., the Hortonia company operates a hydro-electric plant of about 1,200 kw. rating, delivering both 25-cycle and 60-cycle energy. A single waterwheel drives two generators as in other plants noted before. All the 25-cycle energy from this station is sold to the Witherbee-Sherman Company through the Port Henry Light, Heat & Power Company, at Mineville,



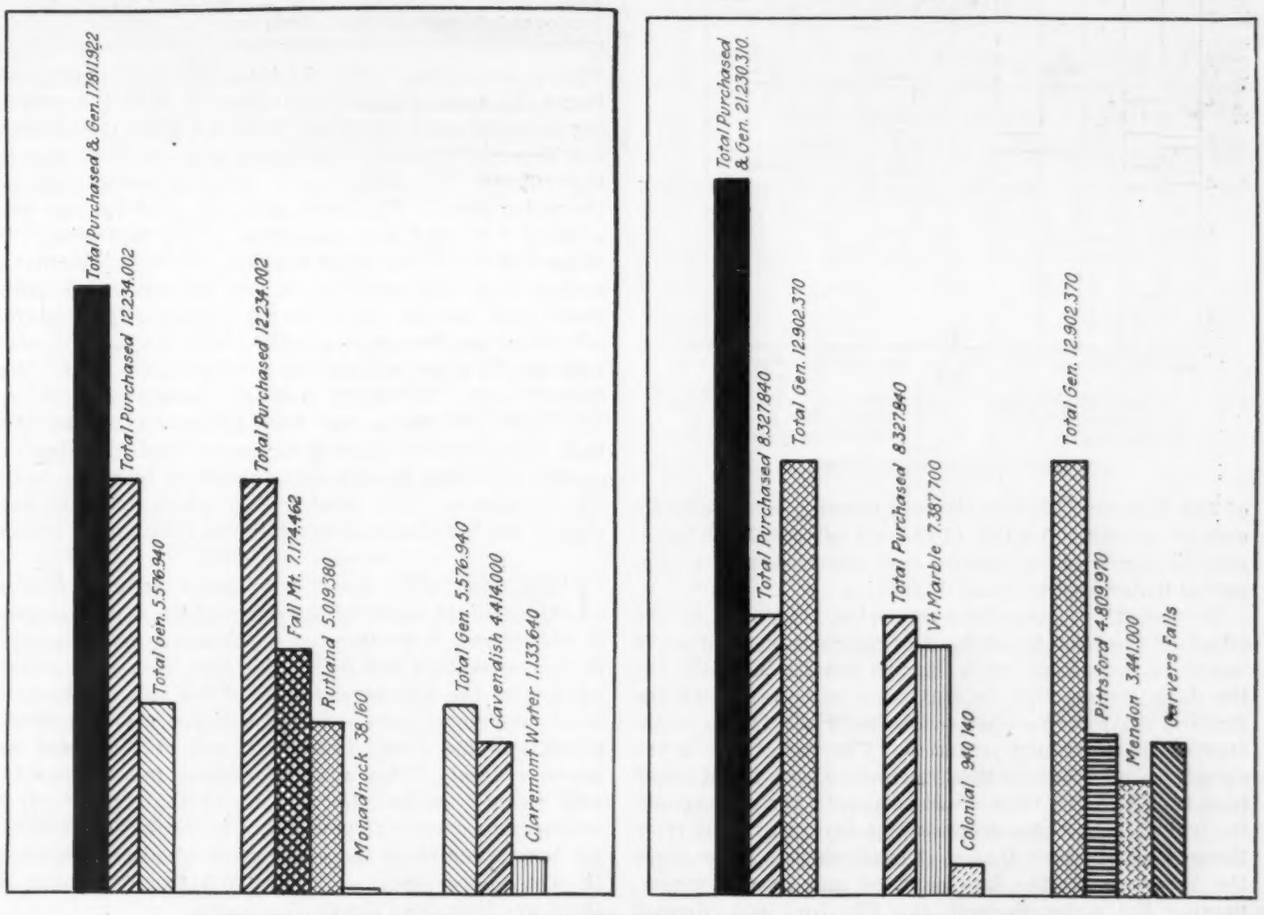
ELEVATION AND CROSS-SECTION OF RUTLAND STATION

N. Y. This industrial company owns the largest magnetic iron-ore field in the country, the annual output being about 1,250,000 tons and the annual energy consumption about 12,000,000 kw.-hr.

FUTURE DEVELOPMENTS EXPECTED

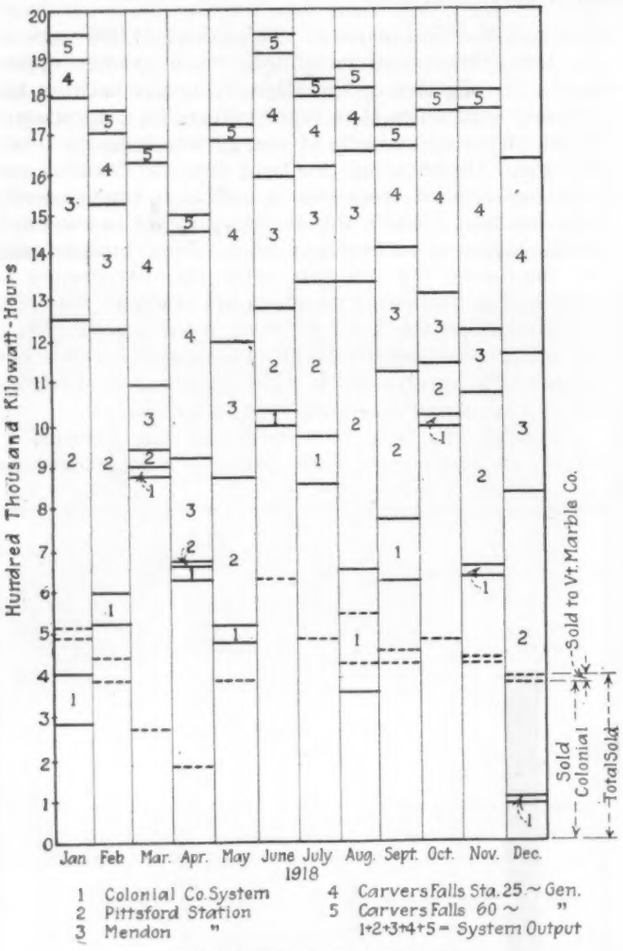
Other power and reservoir sites are owned by the various companies for future development in this district, and as the interconnection program is worked out on the local and adjacent systems a much larger degree of co-ordination than is at present feasible is likely to be accomplished. The Hortonia system is at present connected with the Vermont Hydro-electric system by a tie line recently built between Brandon and Pittsford, operated at 13,200 volts but designed for ultimate operation at 44,000 volts. Near Salisbury the Hortonia lines are connected with the 44,000-volt lines of the Vermont Marble Company. The use of 44,000 volts on the trunk transmissions affords much greater opportunity for effective co-operation in service between the different companies than lower voltage ties, on account of the increased amounts of energy which can be interchanged. On some of the later line construction the wishbone type of cross-arm is used, but comparatively little has been done in this territory as yet to standardize the high-tension overhead work. Opportunities exist for improving the line loss after the distribution of loads and co-ordination of plants are studied. Thus far comparatively little has been done in the way of installing parallel or loop lines, but as time goes on this will undoubtedly receive much more attention in districts where alternative feeds are seen to be feasible.

Although the idea is widespread that Vermont is largely an agricultural state, the various interconnected



SEGREGATION OF PURCHASED AND GENERATED POWER FOR COLONIAL AND RUTLAND SYSTEMS

systems handle very substantial industrial loads and are at present seriously considering the development of water rights additional to those now in service in order to meet the rapidly increasing demands for power. Among its larger customers, the Hortonia company serves tanning, granite, talc, box, marble, kaolin, mines and public utility interests. The Vermont Hydro-Electric Corporation serves a slate mill which has a 3,000-hp. twenty-four-hour load and a range in motor rating of 1 hp. to 250 hp., a scale manufacturer, a marble company, a stone-working machinery manufacturer, a railroad machine shop, a mine machinery company, a large machine-tool manufacturer, and other important industrials, besides the railway, lighting and small power service in Rutland and other communities. The plants



SEGREGATED SYSTEM OUTPUT

of the Vermont Marble Company supply hydro-electric energy to over 100 miles (160 km.) of industrial transmission lines, about seventy-five quarries, and a connected motor load of about 14,000 hp.

In operating these interconnected plants it is the effort of the load-dispatching organizations to conserve water in the reservoirs so far as practicable, utilizing the daily stream flow to maximum advantage. In the Rutland district the Chittenden Reservoir is the mainstay of the hydraulic situation. The variations in the elevations of water in this reservoir above the Rutland base for 1917 and 1918 are shown, with the corresponding rainfall, in the accompanying diagrams, and from these it will be seen that it is customary to draw down the reservoir in the late summer and in mid-winter, passing the water through the Pittsford and Mendon stations, while at other periods, when the stream flows are more ample, the "flash" stations are depended upon to a greater extent.

The operation of the plants is well brought out in the accompanying diagram of daily station outputs for October, 1919. At that time the flow of the Black River at the Cavendish plant, of the Poultney River at Carvers Falls, and the Connecticut River at Vernon permitted the liberal use of these stations, together with the plants of the Vermont Marble Company, while the Pittsford and Mendon stations were run at very moderate outputs. The twenty-four-hour load curve of the system on Oct. 30, 1919, shows how evenly loaded some of these plants were and how little need existed for drawing down the stored water back of the Pittsford and Mendon stations. The block diagram of monthly plant outputs for 1918 also shows how well the stations

INTERCONNECTED HYDROELECTRIC STATIONS
SOUTHERN VERMONT

Station	Location	Operating Company	Kw. Available	No. Units	Head (Ft.)
Pittsford	East Creek	Vermont Hydro	2,200	3	48
Mendon	East Creek	Vermont Hydro	2,100	4	220
Cavendish	Black River	Vermont Hydro	1,500	3	120
Claremont	Sugar River	Vermont Hydro	320	1	20
Carvers Falls	Poultney River	Vermont Hydro	1,040	2	120
Vernon	Connecticut River	N. E. Power System	3,500	8	34
Huntington Falls	Otter Creek	Vermont Marble	1,600	2	40
Beldens	Otter Creek	Vermont Marble	1,600	2	40
Proctor	Otter Creek	Vermont Marble	2,400	3	120
Center Rutland	Otter Creek	Vermont Marble	275	1	30
Hortonville	Benson	Hortonia Power	750	1	176
Brandon	Neshobe River	Hortonia Power	250	2	63
Bristol	New Haven River	Hortonia Power	250	1	115
Silver Lake	Lake Dunmore	Hortonia Power	2,260	1	675
Lake Dunmore	Salisbury	Hortonia Power	2,100	1	178
Gaysville	White River	Hortonia Power	300	1	27
Bethel	White River	Hortonia Power	560	2	16
Middlebury	Otter Creek	Hortonia Power	2,160	3	30
Port Henry, N. Y.	McKenzie Brook	Port Henry Lt. & Pwr.	1,200	1	38

were co-ordinating, with the interchange of energy between the several plants recorded. In 1918 the operating organization took 4,849.760 kw.-hr. from the Chittenden Reservoir, against 4,808.870 kw.-hr. in 1917, and by the efficient co-ordination of interconnected stations the water level in this basin at the close of the year was actually 8 ft. (2.7 m.) above that at the beginning. In other words, efficient plant handling yielded an increased output from the reservoir during the year and added about 1,000,000 kw.-hr. in storage besides. The rainfall at Chittenden Reservoir in 1918 was 43.28 in. (110 cm.) and the Pittsford station used 847,665,000 cu.ft. (24,000,000 cu.m.) of water from the reservoir, or about 176 cu.ft. (50 cu.m.) per kilowatt-hour. During that year the Vermont Marble Company sold the Rutland system 7,377,300 kw.-hr. and purchased from the latter 235,200 kw.-hr. The total energy generated and purchased on the Rutland system was 21,219,810 kw.-hr.

THE *underlying principle of government is justice. Ours might be called the court of the penniless man. A laborer may come who has a grievance, and this court is commanded by law to provide that man with expert advice for the full development of his side of the case. If the aggrieved person is not satisfied, he may appeal directly to the State Supreme Court, still without one penny of cost. They say, "You have taken away the only weapon we had, the weapon of the strike." It is adequate to answer that in every honorable controversy we have given them the much more effective weapon of the state government.*—GOVERNOR ALLEN *of Kansas on the State Industrial Court.*

Calculation of Feeder Voltage Regulation

Through the Use of the Accompanying Chart the Voltage Regulation of a Given Feeder May Be Obtained Readily for Any Load and Power Factor

By W. C. CHAPPELL
Electricity Commissioner, Melbourne, Australia

THE calculation of feeders is recognized by designing engineers to be somewhat tedious, and, while shortened methods have been proposed, they do not give voltage drop and power loss for more than one load. In this article a method is given which, to the writer's knowledge, has not yet been published, whereby this tedious calculation is eliminated. In order to present the method in a clear manner an example will be worked out giving the preliminary calculations for obtaining the size of wire. No attempt will be made, however, to prove the formula used, as this has already been dealt with in the many books on feeder design, and any other formula may be used which the engineer may choose for himself, provided that the voltage drop for a given load is obtained.

The method of calculating feeders radiating from a substation is usually based on an assumed load at the end of the line, an assumed power loss and the requisite size of feeder to suit the requirements of the engineer. Further, the voltage at the substation is constant and the load at the consumers' motors variable. The calculation, however, is based on the maximum load with perhaps provision for some further additional load, and should it be desired to know what voltage and power loss would be obtained at the consumers' terminals if additional motors were installed, the engineer would ordinarily have to make fresh calculations in order to say whether it would be economical.

For the purpose of showing how such calculations may be avoided by the construction of suitable curves, the following illustrative example is worked out.

Assume:

Load at consumers' terminals,	kw	= 0/3,000 kw.
Voltage at substation,	Vs	= 11,400 volts (constant)
Voltage at consumers' terminals,	Vc	= 10,600 volts
Frequency		= 50 cycles
Power factor,	PF	= 90 per cent
Spacing of conductors,	S	= 30 in.
Distance,	L	= 3 miles
Percentage power loss at 3,000 kw., 90 per cent P.F.,	Q	= 7 per cent

Area of conductor in million circular mills is given by:

$$A = \frac{1.04 \times F}{Q} \tag{1}$$

where

$$F = \frac{L \times kw}{(PF \times Vc)^2} \tag{2}$$

Substituting F in (1), we have

$$A = \frac{1.04 \times L \times kw}{Q \times (PF \times Vc)^2} \tag{3}$$

Inserting the numerical values in (3), we have

$$A = \frac{1.04 \times 3 \times 5{,}280 \times 3{,}000}{7 \times (0.90 \times 10600)^2} = 0.0775$$

From wire tables the nearest size of wire corresponding to this area is No. 1 B. & S., which has a

Resistance $= r = 0.678$ ohm per mile.
Reactance $= x = 0.560$ ohm per mile.

Having obtained the size of the wire, the resistance and reactance, the voltage drop can now be calculated:

$$\text{Voltage drop} = P = \sqrt{3} \times I \times L(r \cos \theta + x \sin \theta) \tag{4}$$

where
$$I = \frac{kw \times 1000}{\sqrt{3} \times Vc \times PF} \tag{5}$$

Substituting I in equation (4), we have

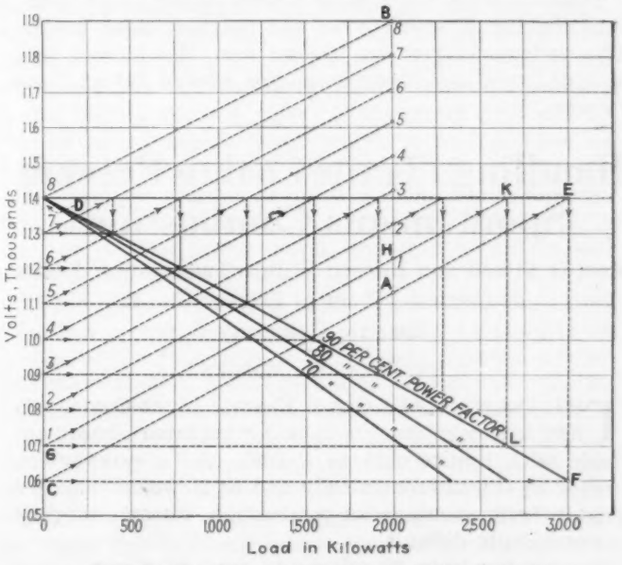
$$P = \frac{L \times kw \times 1{,}000\ (r \cos \theta + x \sin \theta)}{Vc \times PF} \tag{6}$$

Putting
$$(r \cos \theta + x \sin \theta) = D, \tag{7}$$

we have

$$\text{voltage drop} = \frac{L \times kw \times 1000 \times D}{Vc \times PF.} \tag{8}$$

The values of $r \cos \theta$ and $x \sin \theta$ can easily be calculated or may readily be taken from Frederick Warren's "Curves." The formulas for voltage drop given in (8)



CONSTRUCTION OF CURVES FOR FINDING FEEDER VOLTAGE DROP

will only give the drop for values of Vc which are assumed at the consumers' end. What the engineer wants to know is what voltage the consumer will get with different loads with constant voltage at the substation. This can be obtained as follows:

Take any load and power factor, say 2,000 kw. and 90 per cent, and insert in (8), having previously worked out values of D (equation 7).

$$D = (0.678 \times 0.90 + 0.560 \times \sqrt{1 - (0.9)^2} = 0.85$$

$$P = \frac{3 \times 2{,}000 \times 1{,}000 \times 0.85}{Vc \times 0.90} = \frac{5{,}655{,}000}{Vc}. \quad (9)$$

Two values of Vc need only be taken (a) the voltage at the substation, 11,400 volts; (b) the lowest voltage that it is desirable to supply, say 10,600 volts. Inserting these in (9) we have:

	V	P	$V + P$	
(a)	11,400	496	11,896	(10)
(b)	10,600	534	11,134	(11)

On squared paper lay off on the axes load in *kw.* and V (see diagram 1). On the perpendicular through 2,000 kw. find points A and B, namely, 11,134 and 11,896; divide the distance between A and B in eight equal parts or into as many spaces as required between the voltage limits. Draw a line from C through A and continue until it cuts the horizontal line through D, this being the substation voltage. From D drop a perpendicular until it cuts the horizontal line through C at F.

This is one point on the curve for 90 per cent power factor. The same operation is carried out for the rest of divisions, *i.e.*, from G through H to K and down to L and C, and the last point of course must be at D. Connect all these parts together and we now have a curve which will give the voltage at the consumers' terminals for any load with constant voltage at the substation.

With the help of a slide rule, by formulas (3) and (8) any feeder can quickly be calculated, and the voltage drop obtained and plotted on squared paper. Similar curves for 80 and 70 per cent are also drawn in power factor.

Power loss curves may be drawn on the same sheet, thus making a complete set for the particular feeder. The voltages taken are those from the curves just obtained, and the power losses are worked out at these voltages.

Handling Lignite Coal to Prevent Spontaneous Combustion

Fuel Is Mined and Burned Within Twenty-four Hours at Lacombe Plant of Denver Gas & Electric Company

BY ALEX. W. MORGAN

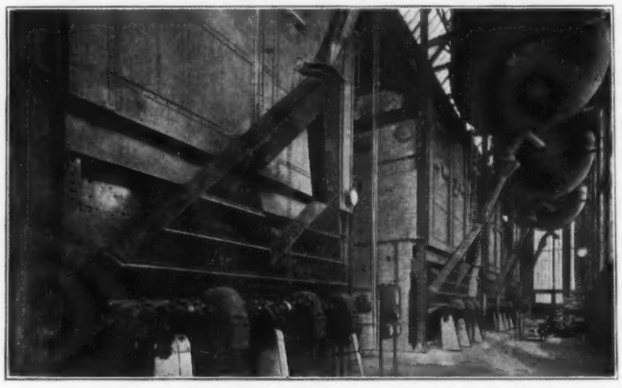
THE Denver (Col.) Gas & Electric Light Company's new Lacombe station is being operated almost entirely with lignite coal as a fuel. As a raw lignite cannot be stored economically and as it would take fire quickly from spontaneous combustion, its safe storage is exceedingly difficult.

Denver is within 30 miles (48 km.) of a very large lignite coal field, and coal that is mined one day is delivered to the power plant the next. This being the case, a continuous supply of coal is always assured to the plant, and therefore no attempt is made to store lignite coal at the plant for emergency use. Whenever coal is to be stored for emergency use a bituminous coal from the southern part of the state is purchased.

There is nothing novel in the coal-handling equipment, and only a brief description of it need be given here. Coal is dumped into a track hopper and from there passes through a Jeffery 24-in. (60-cm.) single-roll crusher which reduces the size of the coal to ¾-in. (19 mm). The coal then drops onto a 20-in. (50-cm.) belt conveyor, which carries it a distance of 114 ft. (34 m.) up 7½ deg. incline and delivers it to a vertical bucket elevator. This elevator carries the coal a distance of 67 ft. (20 m.) to the top of the boiler house and discharges it into a scraper conveyor. The scraper conveyor runs 127 ft. (39 m.) along the top of the four bunkers and is so arranged that coal can be delivered to any bunker. The belt speed is 222 ft. (68 m.) per minute. The scraper speed is 100 ft. (30 m.) per minute, and the entire equipment has a capacity of 60 tons (54 t.) per hour.

BUNKERS OF PECULIAR DESIGN TO MEET VARYING NEEDS OF DENVER COMPANY'S PLANT.

The fact that lignite cannot be stored safely was borne in mind when the bunkers were designed. From the photograph it will be noticed that the bunkers are of peculiar shape and design. They have received various names, such as "inverted parrot cage," "beehive" and "wasps' nest." They are built up of a skeleton steel work consisting of sixty-eight ½ in. (12-mm.) round iron rods bent to shape and fastened at the top into the building steel and at the bottom into a special angle-iron circular form and plate. Two loops of 6-in. (15-cm.) channel iron serve as the main horizontal tie members. Rings of ½ in. (12 mm.) round iron are fastened securely to the vertical members at various intervals, and expanded metal lath is fastened to the inside of the skeleton steel work. On the inside surface of this metal lath was spread a thin coat of concrete, which served as a backer, and then to both inside and outside surfaces of the bunkers was given a 1-in. (25-mm.) coat of cement, shot on with a cement gun, making a total thickness of the walls slightly over 2 in. (5 cm.).



COAL BUNKERS AND COAL SPREADERS ARE FEATURES OF DENVER PLANT FITTED UP FOR LIGNITE COAL

The bunkers will hold between 75 tons (67 t.) and 80 tons (72 t.), which is about the amount of coal that will be used by one boiler in twenty-four hours. From this it may be seen that the engineers have reduced the chance of spontaneous combustion to a minimum. However, there is still one precaution which must be taken even with this arrangement; that is, to see that whenever a boiler is taken off of the line the bunker is emptied. Failure to do this caused two bad fires.

Readers' Views and Comments

Publication of Verbatim Proceedings Wasteful

To the Editor of the ELECTRICAL WORLD:

SIR: Contrary to its former practice, the Southwestern Electrical and Gas Association has not this year and did not last year take stenographic notes of its operating sessions or publish its proceedings.

I believe that there has been an immense amount of money wasted by organizations similar to ours in the publication of the verbatim proceedings of their conventions and other meetings. While these are interesting and possibly valuable to a few of the members and others, the larger portion of them might as well be immediately sold to the junk man. A long-continued inquiry and observation among our members and among those of other similar organizations has elicited the fact that the printed proceedings of the organizations have very seldom been looked into after the glance given them on their receipt, and while in some cases they make an imposing addition to the office bookcase, I have found nearly always that that has been their only benefit.

H. S. COOPER,
Secretary.

Dallas, Tex.

Safety Features of the Double-Base Lamp

To the Editor of the ELECTRICAL WORLD:

SIR: The writer of the criticism of the double-base lamp appearing on page 1267 of your May 29 issue evidently did not notice that this lamp is supplied with a threaded and insulated receptacle permanently attached to the free end. By this means the supposed dangers to which he refers are eliminated just as completely as they are in any standard socket.

The device is not a complicated arrangement, but on the contrary is extremely simple, symmetrical and sightly—statements that can scarcely be made in many cases of the current taps and double plugs on the market. The "complications" referred to are evidently the attachments which the inventor suggested for use with the lamp, whereby ordinary chain pendent fixtures might be converted into modern lighting units.

I can scarcely agree that it is "neither desirable nor economical" always to have the light burning when the lower end is in use. This might be true if one looked at the matter exclusively from the viewpoint of the manufacturer of wiring devices, but if viewed broadly, it is seen that this feature of itself is one of the valuable points of the device. This is the case because it gives a reliable indication that the appliance is connected on the circuit. This, in the almost universal absence of pilot lamps, tends to make the use of appliances of all kinds more safe, and this assurance and freedom from appliance burnouts should much more than offset the small waste of light which might or might not occur. For the larger sizes of lamps, if found desirable, a switch might easily be incorporated whereby the use of the appliance would be made independent of the burning of the lamp.

EDWIN D. TILLSON.

Commonwealth Edison Company, Chicago.

The Problem of Inductive Interference

To the Editor of the ELECTRICAL WORLD:

SIR: I feel that the report of the committee on inductive interference presented at the recent National Electric Light Association convention was somewhat disappointing, owing to the fact that it caused alarm in the commercial and administrative departments of the N. E. L. A.

Such a state of affairs is unnecessary, as we know what we are facing in the fact that wherever power circuits are built communication circuits will be operated also and of necessity will soon reach places where parallel lines cannot be avoided. The recent voluminous report of the California committee on inductive interference has presented some very valuable technical data which should be sufficient for solving the technical problems involved in parallel-circuit operation.

Inductive interference can in large measure be reduced to a negligible quantity by scientific transposition. In this connection it is well to point out that many of our present high-voltage transmission lines are not transposed and that it will be very expensive to rebuild them, although this seems unavoidable.

New prime movers should be ordered with a wave form that will reduce inductive interference to a minimum. This would be in accordance with the standardized rating of the American Institute of Electrical Engineers. However, since there are so many prime movers in operation which have wave forms productive of voltage waves containing the injurious harmonics, some method should be evolved for correcting their wave forms. These prime movers cannot be thrown away, of course, and I would suggest that the committee of inductive interference conduct experiments toward correction of the wave forms.

The following method of suppressing harmonics appears not impossible of application: After the amplitude and phase angle of the harmonics have been determined, a small generator set having the necessary characteristics may be attached to the generator shaft which would produce current corresponding to the harmonics in the main generator wave. The current produced by the correcting generator set would be superimposed on the primary wave at 180 deg. phase angle and thereby counteract the original harmonics. The size of the correcting generators would, of course, be proportional to the size of the prime mover and to the quality and quantity of the harmonics.

If the inductive interference troubles were confined to a few communication lines, it would be possible to eliminate the interference in the way pointed out by the connection of small generator sets directly to the telephone line. An alternative would be to install tenatron generators tuned in opposition to the interfering wave induced in the communication circuit. In the case of long communication circuits which utilize the high-frequency carrier waves, interference will not be experienced due to parallels with power circuits, but it is not anticipated that the system of using carrier waves will become universal.

In conclusion, I believe that if the Technical Section of the N. E. L. A. will work in harmony with the technical representatives of the telephone company, a great many of the difficulties will be ironed out to the profit of both.

J. A. LIGHTHIPE,
Chief Electrical Engineer.

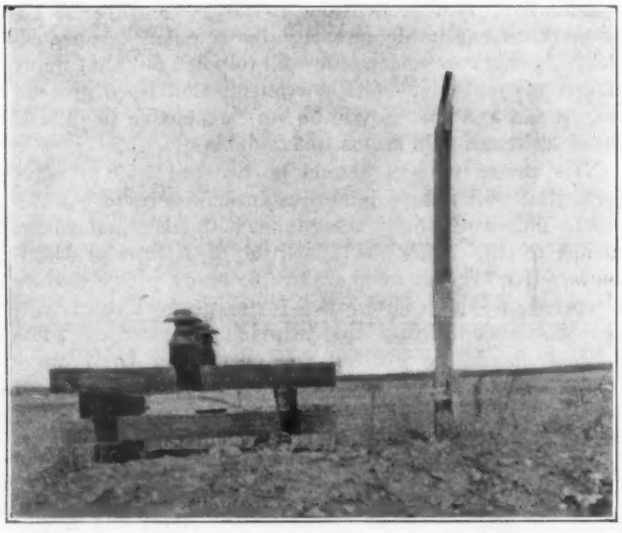
Southern California Edison Company, Los Angeles, Cal.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Stack of Cross-Ties as Emergency Support for 60,000-Volt Line

BY USING stacks of railroad ties for supporting a 60,000-volt line, service was quickly resumed after a recent storm blew down several poles of the Pacific Gas & Electric Company. These piles of ties were built



RAILROAD TIES USED TO SUPPORT 60,000-VOLT LINE AFTER POLES WERE BLOWN DOWN

up high enough to keep the wires clear of the ground, and the pin-type insulators which were on the poles were set, with the wires attached, on the top tie. After the line was reported clear a watchman was stationed to guard it. Service was successfully maintained over the temporary line until other arrangements were made.

San Francisco, Cal. P. M. DOWNING.

Four-Valve Engine Shows Economy Over Turbine

THE fuel consumption of a small Kansas central station burning oil was about cut in half by substituting a four-valve Ridgeway engine for a horizontal type turbine operated non-condensing. The original installation consisted of two 650-kva., 3,600-r.p.m. turbines operated without condensers and discharging into a heating system against a back pressure of 5 lb. to 8 lb. (0.35 kg. to 0.56 kg. per sq.cm.). With this installation the consumption of oil in December, 1919, was 1.5 gal. (5.3 l.) per kilowatt-hour, and there was always more exhaust steam than was required for heating. When the new unit was put in, a 500-kva., 150-r.p.m., four-valve simple engine, this consumption dropped to 0.8 gal. (3 l.) per kilowatt-hour, including the oil used to generate some live steam for heating. On account of this difference in consumption one of the turbines has been removed and the other has been equipped with a condenser to increase its efficiency. Other improvements are being made in the method of burning the oil, and still better consumption records are expected later.

FRANK M. STONE,
General Manager.
Fort Scott (Kan.) Gas & Electric Company.

Chart Facilitates Steam-Flow Calculations

FOR calculating velocity, size of pipe, steam flow or steam pressure, when any three of these conditions are given, the chart shown here has been found to save time. To illustrate the use of the chart, suppose it is necessary to find the size of pipe required to deliver 6,000 lb. of steam per hour at 110 lb. gage pressure, allowing a velocity of 4,000 ft. per minute. On the 4,000-ft.-per-minute line trace diagonally to the intersection with the dotted 110-lb. pressure line. From this intersection trace horizontally to a point on the 6,000-lb.-per-hour line. The nearest pipe-size line to this point (4 in.) shows the size of pipe to use.

Taking another example, suppose that it is required to find the pounds of steam delivered per minute through an 8-in. pipe at 100 lb. pressure and with a velocity of 6,000 ft. per minute. To solve this, trace the 6,000-ft. velocity line to intersect the dotted 100-lb. pressure line. Follow horizontally from this intersec-

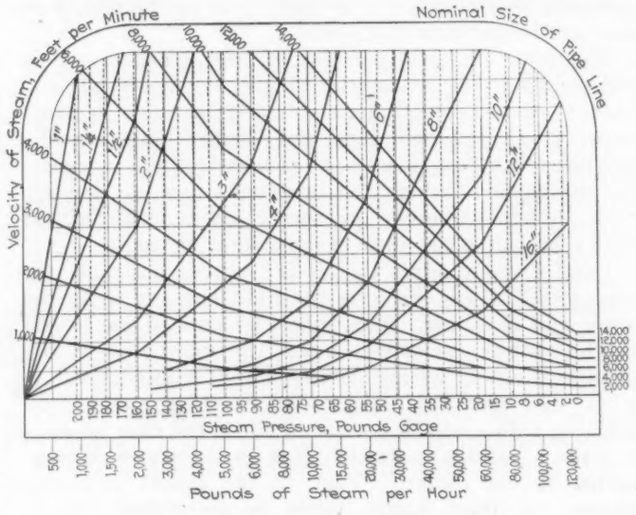


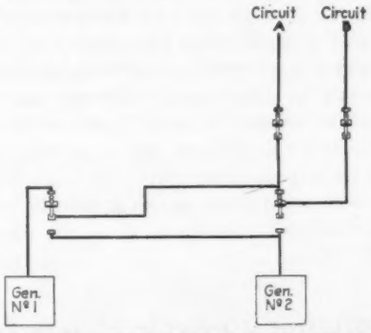
CHART FOR CALCULATING STEAM FLOW

tion to a point on the 8-in. pipe line and directly below this point is found the discharge, which is 32,300 lb. of steam per hour.

The chart shown here is an abridgment of a large chart made by the Republic Flow Meters Company, Chicago.

Feeding Two Circuits with Generators Which Cannot Be Paralleled

WHERE two generators which cannot be paralleled are required to feed two circuits on which the load varies the scheme illustrated herewith has proved useful. By means of this connection both circuits may be fed from generator No. 1, both circuits may be fed from generator No. 2, or A may be fed from No. 1 while B is fed from No. 2. If only one of the circuits is to be made alive, it may be fed from either No. 1 or No. 2. With such an arrangement it is impossible to tie the



THESE DISSIMILAR GENERATORS CANNOT BE PARALLELED, ALTHOUGH THE CIRCUITS MAY BE TIED TO EITHER OF THEM

two generators together no matter which way the switches are thrown. As there is no arrangement for even temporarily tying the two generators together, one outgoing circuit cannot be transferred from one generator to another without temporarily dropping the load on the circuit.

W. A. DARTER.
Brenham Compress, Oil & Manufacturing Company.
Brenham, Tex.

Waterproofing Overhead Coal Bunkers

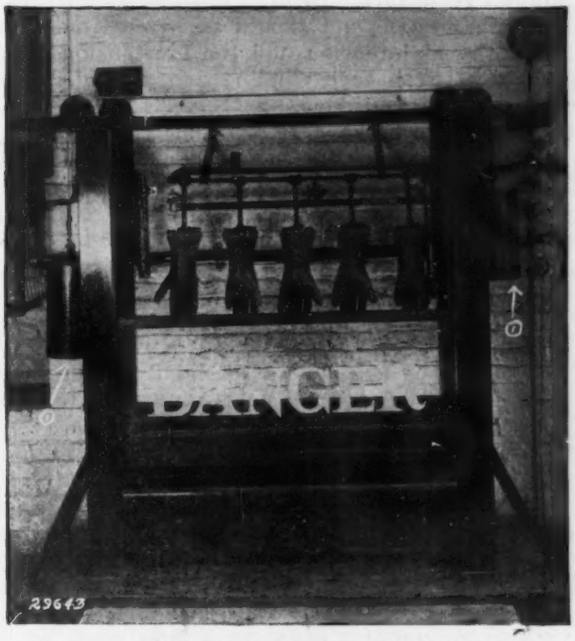
TO PREVENT acid water from coal bunkers falling into the boiler room and attacking the metal parts, the United Light & Railways Company, Davenport, Iowa, has waterproofed the bottom trough of the bunker in its new Moline (Ill.) boiler house. This was accomplished by covering the lower sections of the bunker with a membrane waterproofing consisting of three independent layers of asbestos felt secured together and held to the initial concrete surface by layers of hot asphalt water-proofing cement.

C. S. LLOYD.
Chicago, Ill.

Tank for Quick and Safe Tests on Rubber Gloves

FOR safely and quickly making voltage tests on rubber gloves, a large central-station company makes use of a wooden tank, metal lined, filled with water so arranged that it can be raised or lowered in an insulated wooden testing rack while the gloves are held stationary at the top of the rack. Metal cables fastened at each end of the tank are attached to heavy counterweights. A glass shield is attached to the tank and moves up and down with it. The advantages of this arrangement are that there are no exposed ungrounded high-voltage parts. The two high-voltage testing terminals are arranged as follows: One is placed inside of a fiber tube, the upper end of which is sealed and insulated and the lower end left open, so that when the water tank is raised the water enters the bottom of the tube and makes contact with this terminal. The other high-potential terminal consists of the entire water-piping system, with the glove holders and pipes used for filling the gloves, all of which are permanently grounded at all times and remain in a fixed position, irrespective of whether the tank is raised or lowered. When the tank is lowered the ungrounded circuit is always broken, so that the tester has plenty of room to adjust the gloves on the disks in their test position without coming in contact with any live terminals. The tops of the gloves are kept perfectly dry and the insulation intact, as the gloves are gradually submerged until the water reaches a point about 1½ in. (3.8 cm.) from the top of the gauntlet. When the tank is raised electrical contacts are automatically made and all live parts are inclosed within the glass shield, thus effectively protecting the operator.

The gloves are stretched over grooved metallic disks and fastened to them by two thick rubber bands stretched over the top of the gloves. The water pipes extend through the disks, project down into the water inside of the glove and act as a high-potential testing terminal. They are also used for filling the gloves with water and, after the test has been completed, emptying them by siphon action when the valve in the exhaust pipe leading to the sewer is opened. Stopcocks are provided on the metallic glove-holding disks so as to allow the air to escape while the gloves are being filled with water. As soon as the water begins to flow out of the cocks they are turned off and a pressure gage is used to adjust the water pressure in



NO LIVE PARTS OF THIS GLOVE-TESTING TANK CAN BE TOUCHED BY OPERATOR

the gloves, which is usually held at about 1½ lb. to 2 lb. per square inch (0.1 kg. to 0.14 kg. per sq.cm.).

Among other safety features of the equipment is an insulated testing stool always left in front of the glove-testing rack. The high-potential control panel is provided with an automatic spring switch, which remains open unless held closed by the operator. The distance between the control-switch panel, the testing transformer and the test rack is ample but so adjusted as to permit the results of the test to be

easily observed through the glass shield inclosing the gloves under test.

This equipment was described at the Los Angeles convention of the N. E. L. A. by the committee on accident prevention.

Drying Transformer Insulation and Oil Before Operating

BEFORE transformers are put in operation the insulation should be thoroughly dried if the transformer is for over 10,000 volts, and the oil should be tested for moisture for voltages even as low as 2,200 volts. The best method of drying transformer insulation is to send current through the coils. Direct current can be used for this method, but it is usually not available. When using alternating current about 3 per cent of the high tension voltage should be employed. For instance, on a 60,000-volt transformer 1,800 volts should be used. Before applying this voltage the low-tension winding of the transformer should be short-circuited and an ammeter and fuse should be put in the circuit for protection. With about 3 per cent of the high-tension voltage on the high-tension leads, full-load current will be flowing in both windings. The temperature should be watched closely to see that it does not run over 80 deg. C.

During drying, tests should be made at least hourly on the resistance of the insulation. These tests may be made with a 500-volt voltmeter, a megger or a good Wheatstone bridge. When heat is first applied the insulation resistance will drop off, but it will gradually begin to rise and should be several megohms between the high-tension and the low-tension windings, and between each winding and ground, before the drying is discontinued.

Oil shipped in tanks, cars or drums is sure to contain some moisture and it is not safe to use even in 2,200-volt apparatus without testing and if necessary drying to remove the moisture. The only sure way for testing oil is in a spark gap. On a 0.015-in. (0.37-mm.) gap the oil should stand 25,000 volts for a 6,600-volt transformer, and for higher voltages it should stand 30,000 volts or more. The best dry oil obtainable will stand about 50,000 volts. A rough test for moisture in oil is to plunge a red-hot iron into it and note the sound. A hissing noise indicates the presence of considerable moisture. Before the oil is passed into any kind of a filter it should be allowed to stand a few minutes in order that the water may settle.

As oil thickens in cold weather, this will take a longer time than in hot weather. Even if the oil test is satisfactory, it should be strained through doubled cheese cloth to remove drum scale and other dirt. For drying oil which contains moisture a filter made up of layers of sand and quicklime may be used, or a blotting paper filter press. A slow and laborious method is to drive the moisture out as steam by heating the oil.

When quicklime is available oil may be strained into a large funnel containing lumps of the lime, with two thicknesses of cheese cloth tied over the spout. The oil can then be passed through the cheese cloth into the filter press, if one is available, or if not, it may be passed through a new batch of quicklime a second and a third time. As soon as this lime is half pulverized by taking up water, it must be renewed. This treatment of oil must be done in a room free from moisture in the air, as oil will absorb moisture from air nearly as fast as lime takes it out.

If a filter press is available, after the oil is passed through one funnel of lime it is pumped through the press. The blotting paper in the press must be changed frequently, about every fifteen minutes, until all the oil has passed once through the pump. This paper will take out only as much oil as it can soak up, after which it will pass the water through. When this occurs the pump gage will indicate excessive pressure, rising from the ordinary pressure of 20 lb. to about 150 lb. (1.4 kg. to 10.5 kg. per sq.cm.). With a great deal of sediment the pressure may run as high as 160 lb. (11.2 kg.). The best results are obtained with the press by thoroughly drying the paper and using about five sheets in each space of the filter.

Before placing the filtered oil in a transformer the tank should be wiped clean with dry rags (not waste). Clean rags wet with pure alcohol should be used for the second wiping if the tank is at all damp.

Cleveland, Ohio. JAMES DIXON.

Changing 25-Cycle Meters for 60-Cycle Operation

CHANGING 25-cycle meters to operate on 60 cycles was done recently without a great deal of expense or labor by the Choctaw Power & Light Company, McAlester, Okla. This change was necessitated by the changing of the distribution system from the old 25-cycle frequency to the standard 60-cycle frequency. For making the change on General Electric type I meters, the lag coils and the light-load adjustment plates were removed and standard 60-cycle lag coils and light-load plates were substituted. The cost per meter, including labor, was 77 cents. The difference in the 25-cycle and the 60-cycle lag coils lies in the fact that the 25-cycle coils have one very heavy turn of copper in addition to a large number of small turns. This single heavy turn is not in the 60-cycle coils. Moreover, it cannot be removed from the 25-cycle coils without destroying them; therefore, it was necessary to install new coils. To change the meters to standard 60-cycle meters would have required changing the shunt coil and the register as well as the lag coil and light-load plates, which would have increased the cost of the change about $2.60. On the General Electric type D-3 polyphase meters the same change was made at an expense of about $1.50, including labor and calibrating. For making the change on a number of Fort Wayne type K-5 meters it was only necessary to remove the upper or fixed lag plate used in 25-cycle meters to make them correct for 60-cycle service.

After the change it was found that the meters had very nearly as good characteristics as the standard 60-cycle meters. No change was made in the register, shunt coils, series coils or disk constants. The torque being practically the same as in the 25-cycle meters, the disks run at half the speed of the standard 60-cycle meters. No trouble was experienced in calibrating the meters, although it was thought at first that new magnets would have to be installed to obtain the desired calibration over the entire range. However, all meters had to be relagged and calibrated on inductive load.

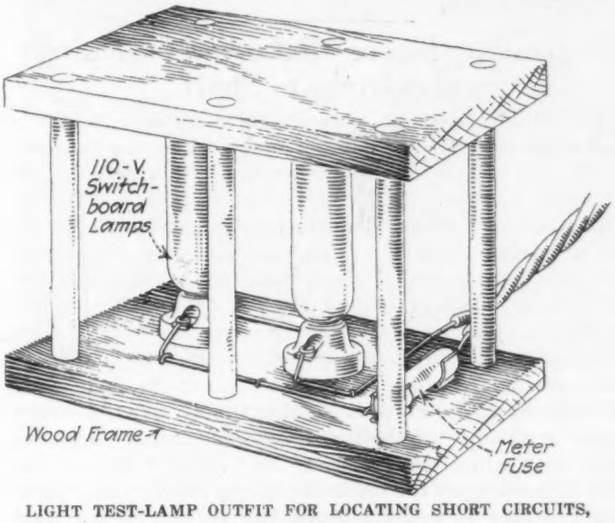
Choctaw Power & Light Company, P. M. CORDELL.
McAlester, Okla.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Light and Small Test Lamps

BY MOUNTING in a light wooden frame two small 110-volt lamps such as are used in signal lights on switchboards an Eastern testing department has made a very convenient device to be used in the same manner as the ordinary larger testing lamps. These two lamps are mounted in series, and a small meter fuse such as is



LIGHT TEST-LAMP OUTFIT FOR LOCATING SHORT CIRCUITS, GROUNDS, ETC.

used on the back of switchboards is inserted in the circuit to prevent damage in case one or both of the lamps are short-circuited. Two flexible leads about 5 ft. (1.5 m.) long are attached to the lamps. This device is used for roughly ascertaining the voltage on 110-volt and 220-volt lines, for testing for grounds, short circuits, open circuits, etc. EDWARD HATCH.

New York, N. Y.

Keeping Electrical Machines Warm Prevents Sweating

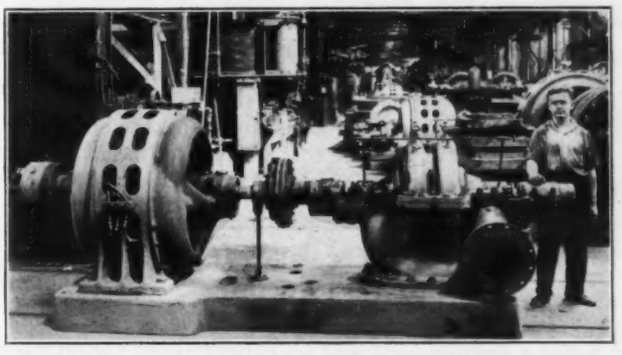
IF THE room temperature where electrical machinery is kept is uniform at all times, or if the machines are kept slightly warmer than the surrounding air, sweating of the machines will be prevented. Sweating is the result of a difference of temperature between a machine and the surrounding air. If the air is saturated at a certain temperature and is cooled below this point, it gives up some of its moisture. When the temperature of a machine is low enough to reduce the temperature of the air below the dew point all excess moisture is precipitated upon the machine. This is very injurious to the insulation of electrical apparatus. For this reason the room in which electrical apparatus is stored by the user should be kept at an even temperature. The apparatus should also be covered to keep out dust and dirt.

After machines are installed arrangements should be made to keep them slightly warm. During periods of more or less extended shutdown the machines should be covered by tarpaulins, and a small amount of external heat should be applied to keep the machines at a temperature that will prevent sweating. Where high-voltage alternating-current machines are installed in localities having high humidity, schemes have been worked out whereby 220-volt alternating current can be applied to the motor windings by simply switching the motor from its power line to the shop circuit. This can be done very quickly and only a small amount of power is required. The heat is applied internally, and it is only necessary to keep the temperature a few degrees above that of the surrounding atmosphere to prevent precipitation. Some operators have arranged electric heaters made up from grids, and others place steam pipes under the motors to keep them warm during shutdowns.

East Pittsburgh, Pa. O. NEEDHAM.

Synchronous Motor Starts Primed Pump Through Magnetic Clutch

ONE of the disadvantages of using synchronous motors to drive centrifugal pumps is the large pull in torque which is required when the motor is started after the pump has been primed. To overcome this difficulty the city of Coffeyville, Kan., decided to use a magnetic clutch between the motor and pump, as shown in the illustration. This clutch permits the load to be



MAGNETIC CLUTCH PERMITS SYNCHRONOUS MOTOR TO START CENTRIFUGAL PUMP UNDER LOAD

gradually applied to the motor so that it starts without trouble.

The hydraulic part of this equipment consists of a 10-in. (25-cm.) two-stage hydraucone centrifugal pump rated at 2,080 gal. per minute (130 l. per second) when operating against a head of 233 ft. (71.). The electrical end consists of a 200-hp., 2,300-volt, three-phase, 60-cycle, 1,200-r.p.m. synchronous motor. Both of these machines were manufactured by the Allis-Chalmers

Manufacturing Company. The magnetic clutch, which is energized from the direct-current exciter on the opposite end of the synchronous motor, was manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Insulating Ends of Motor Coils with Cambric Saves Time

BY USING sheets of varnished cambric between the overhanging ends of motor coils instead of wrapping them with tape, an Eastern repair shop saves much time in rewinding alternating-current motors. Triangular strips of the varnished cambric are cut out of sheet material and these triangular pieces are inserted underneath the protruding end of every coil just after the coil is put in place. Between coils of the same phase only one thickness of the fabric is used, and between different phases two thicknesses are employed. The triangles are cut large enough to extend across the end of the coil and leave no part uninsulated from the adjacent coil. After all the coils are in place the varnished cambric is trimmed to the shape of the coil. The pressure of the coils against one another is sufficient to hold the fabric securely in place. Both rotor and stator coils are insulated in this manner.

INSERTING VARNISHED CAMBRIC BETWEEN ADJACENT COILS TO SAVE TIME OF WRAPPING WITH TAPE

This method of insulation is much quicker than the commonly followed method of wrapping the ends of the coils with tape. It is estimated that about two-thirds of the time of wrapping is saved by using the sheets of varnished cambric, and the cost of material is not much greater when using the cambric. C. A. JOHNSON.

Bronx, N. Y.

New Devices Increase Safety of Automatic Elevator

A TIME relay which holds the elevator at a stop for a definite time and an arrangement for quickly changing from automatic operation to manual are features of the electric elevators recently installed in the Los Angeles (Cal.) County Hospital. This time relay necessitates the lapse of a limited time, adjustable from a few seconds to a minute, after the car has stopped before it can be moved again. This gives invalids or nervous persons ample time to open the doors and make their exit from the elevator before the car can be started by any person on another floor. On the same panel with the relay is mounted a two-way switch by means of which the elevators can be operated by hand control or by automatic control. By touching the corridor button the elevator is automatically brought to the landing at which the button is pressed, and by touching the same button when the hand control is on a call is shown on the enunciator in the car.

As a safety precaution the contact block on the door is mechanically removed from the switch box when the door is opened, thus breaking the operating circuit when any door is open. In the switchbox there is a pawl which drops into a ratchet on the door when the car is away from the landing, making it impossible to open any doors when the car is in motion. When the car stops at a landing the pawl is automatically prevented from engaging the ratchet, thus enabling the door at which the car has stopped to be opened.

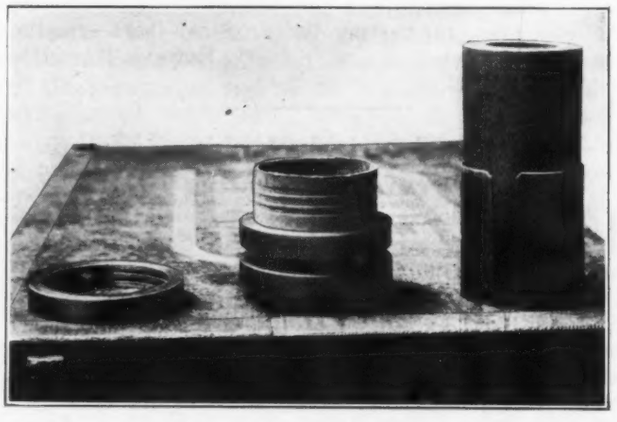
The time relay switch also operates when the elevator is run in the usual manner by an attendant. Because of the noise made in closing a sliding door, a noiseless hinged door is employed. C. W. GEIGER.

San Francisco, Cal.

Expanding Sleeve Method of Fastening Slip Rings to Shaft

BY MEANS of an expandable metal cylinder into which a steel core is pressed slip rings may be fastened onto the shaft without the bolts, etc., used in the ordinary method. This expanding cylinder consists of a simple sheet of metal made into cylindrical form, as shown at the right of the photograph. The insulation, consisting of layers of sheet material, is placed inside the rings, which are then slipped over the cylinder. After the cylinder and rings are arranged a metal core is pressed into the inside of the cylinder, expanding it and causing the rings to tighten against the insulation. In order that the core may enter the cylinder, a slight taper is given to the bottom end of the core. The pressure with which the rings are held against the insulation depends upon the thickness of the insulation. While the pressure is being applied the slip rings are held apart by small spacing blocks.

In the center of the illustration is shown the condition of the insulation when the core has been removed from the slip rings. It will be noted that the slip ring has pressed grooves in the insulation so that it evidently was firmly held on the core. When the rings are put on the shaft the core, of course, remains inside.

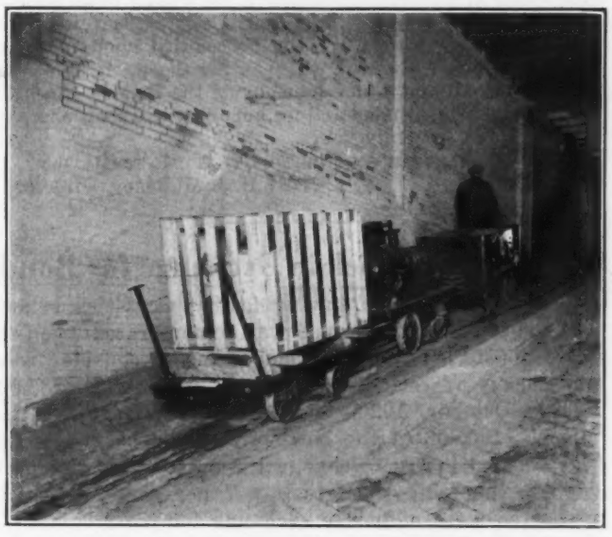


CORE PRESSED INTO EXPANDING SLEEVE HOLDS SLIP RINGS TIGHT
In the center is cylinder with one ring removed, showing how the ring has compressed the insulation.

This method of applying slip rings is controlled by the Elektrotechnische Industrie, voorheen Willem Smit & Company, Slikkerveer, Netherlands, and patents have been applied for.

Electric Tractor Does Heavy Hauling on 25 per Cent Grade

AN ELECTRIC tractor hauled all the heavy machinery exhibits up a 25 per cent ramp from the first floor to the third floor for the recent Cleveland electrical show. This building, the large new Winton garage building, was not equipped with elevators, and as it was not desired to use a block and tackle, which would have been very slow, a "QTQ" Baker tractor of the four-wheel-drive type, equipped with twenty-four-cell batteries, was



HAULING HEAVY EQUIPMENT UP A 25 PER CENT GRADE WITH AN ELECTRICAL TRACTOR

employed. This tractor handled all the loads satisfactorily, sometimes carrying as much as 10 tons at one trip. This 25 per cent ramp is so steep that the owners of the building have now decided to tear it down and to replace it with one having an easier slope.

Cleveland, Ohio. D. L. DARNELL.

How to Remedy Some Synchronous Motor Troubles

SOME temporary repairs to synchronous motors which can be made to restore service quickly are outlined in the following paragraphs. The possible troubles which may develop in synchronous motors are: (1) Burned-out coil in stator; (2) short-circuited or grounded coil in rotor; (3) auto-transformer burned out; (4) motor will not start although all connections are correct.

Regarding the first of these troubles, a burned-out stator coil can be cut out of circuit in the same manner as a coil in an alternator or an induction motor. To do this the coil is disconnected and a jumper is put across in place of it. If the coil is also short-circuited between turns, it must be cut in half to prevent overheating. After the coil has been disconnected the motor will operate, but the currents will not be balanced and a new coil should be put in the motor as soon as it can be taken out of service.

The second trouble, a short-circuited coil in the rotor, is very uncommon. Such a shorted coil will decrease the magnetism of its pole and cause unbalanced magnetic pull which may result in bearing trouble and mechanical stresses in the stator. For temporary repairs a jumper may be put around the bad coil and also around the good coil, which is exactly opposite on the rotor, so the rotor will be balanced magnetically. These jumped poles will be weaker than the other poles, and the ability of the motor to correct power factor will be reduced. The motor speed will not be changed. As rotor coils are often wound with bare strip copper, any trouble is likely to include grounding the rotor winding. If the exciting circuit which feeds the rotor is also grounded, as is frequently the case, the result is to shunt out entirely a part of the rotor coils. Such a grounded rotor coil may be cut out and service restored in the same manner as a shorted coil.

A common trouble is burn-out of the auto-transformer. This is particularly frequent on older installations made before the unusually severe duty required of starting devices for synchronous motors was appreciated, when the auto-transformers were made too small and with parts not properly braced and supported. Burn-outs in the coils can sometimes be repaired in the field by cutting out damaged sections or by retaping if the coils are strap-copper-wound. When reassembling, the joints should be made with the utmost care and the coils and core should be well braced and bolted down.

When a synchronous motor will not start with all connections correct and current actually reaching the motor on all phases the trouble is usually overload or low voltage.

To determine if the load which the motor is required to start is too heavy, the starting power required should be compared with the starting ability of the motor. The starting ability of synchronous motors is not great. Usually such a motor will not start more than 30 per cent of its rated full load. The exact starting ability of a motor may be obtained from its manufacturer.

To determine the power required to start the load a suitable lever arm is attached to one of the driven shafts or the motor shaft and weights are put on the end of the lever which will just turn the loaded shaft. Then by application of the following formula the power required is calculated:

Starting hp. $= (W \times L \times 6.28 \times \text{r.p.m.}) \div 33{,}000$, where W = weight in pounds, L = length of lever in feet, r.p.m. = speed of the shaft when motor is running at full speed.

If the required starting power as determined by this formula is greater than the starting ability of the motor, the load is too great. It may happen that the power required is within the ability of the motor and still the load may not start owing to excessive drop in line voltage caused by the heavy starting current. This can be overcome by connecting the starting leads in the auto-transformer to the next higher tap, thus supplying the motor with higher voltage for starting. Increasing the starting voltage to overcome excessive starting load is likely to result in severe strains on the stator windings. This should be avoided.

It is important in starting up a synchronous motor to avoid touching the metal parts of the rotor circuit before it is closed. During starting an alternating voltage is induced in the rotor circuit by transformer action. This voltage is sometimes 1,500 or more, and making contact with the rotor collector rings, brush gear or field switch is dangerous. JAMES DIXON.

Cleveland, Ohio.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Advantages of Simplifying Ledger Accounts

MANY of the large utilities have the custom of keeping separate accounts for each meter and flat-rate account. This frequently results in three or four ledger sheets for one customer and in an equivalent number of bills being sent out monthly. Aside from the expense to the company, it is confusing to the customer and may result in misunderstandings.

After experiencing some difficulty under this method, the Washington Water Power Company adopted the practice of confining all accounts under the name of one customer to one ledger sheet, provided that they originate from the same address. On this page are entered the flat-rate and metered accounts and also any sales through the appliance sales department. This has materially lessened billing expense, and at the same time it obviates the possibility of the customer being annoyed by a second bill following on a few days after the first.

Increased Operating Costs Affect Both Newspaper and Utility

IN RENEWING its subscriptions to 300 newspapers throughout the state the Illinois Committee on Public Utility Information points out that subscription prices have largely increased and in the following letter addressed to the editors draws an interesting parallel of increased operating costs affecting the newspaper and the utility alike:

DEAR SIR: Inclosed find check covering renewal of our subscription for the coming year. While we note by the bill of practically all Illinois newspapers to which we subscribe that the price has been largely increased, we appreciate that newspapers have been confronted by the same after-the-war dilemma as the public service companies—that of having a fixed price for their commodity and no strangle-hold on rising costs of production. We appreciate that if a newspaper proprietor continues to stay in business—buy paper, ink, machinery, pay current labor costs and serve his community and patrons as capably as in the days when production costs were not so high—he must have revenues commensurate to meet the increased prices, just as we have been insisting in behalf of the utilities over the last year. And we believe his customers should be fair with him about it.

Were a newspaper "starved" we would not renew our subscription to it, for the inefficient service it would render in the way of presenting the news of the community would be dear at any price. Our belief is that a well-supported newspaper can do a much more constructive and useful work in the community than a poorly supported one.

We have been gratified to find that the press of the state, with but few exceptions, appreciates the problems of the utility industry in these difficult times and is fairly presenting to the public what underdevelopment, resulting from "starvation" of electric light and power, gas, electric railway and telephone service, would mean to the growth and prosperity of the state and to all business. Liberal use has been made of material contained in the weekly news bulletin issued by the committee, but this is not extraordinary, as Illinois newspapers can usually be counted upon to aid in promoting any movement which is for the public good and intended to stimulate development of the state. The news service will be continued and we hope you will find increased use for it. Very truly yours,

ILLINOIS COMMITTEE ON PUBLIC UTILITY INFORMATION,
By B. J. Mulloney, Director.

Utility Issues Stock in Exchange for Bonds

THE advantage of having utility securities held in the communities served was demonstrated when the Mexico (Mo.) Power Company came to consider ways and means of retiring 6 per cent bonds for $235,000 due in October, 1920. An investigation showed that almost $100,000 of the bonds were held locally, and it was decided to try to change these creditors into partners by inducing them to buy 7 per cent cumulative preferred stock at par in exchange for their bonds. A preferred stock issue of $400,000 was authorized to retire the bonds and to make improvements and additions to the property. The stock was first issued on Oct. 1, 1918, and within four days E. R. Locke, vice-president and treasurer of the company, was able to report that every bondholder in and around Mexico had been converted into a holder of the company's non-maturing securities. The remainder of the bond issue, amounting to $135,500, was held by banks and widely scattered investors who were not susceptible to the same appeal, but the company's customers are supplying the money, in exchange for stock, to retire all the outstanding bonds.

Since the summer of 1919 the company has constructed 75 miles (120 km.) of transmission lines to supply service to practically all towns within a radius of 25 miles (40 km.), and all the work has been financed by the sale of the company's 7 per cent preferred stock. The new communities supplied with service were asked to buy a sufficient quantity of the company's preferred stock to cover the cost of the line, and in every case the money has been forthcoming. The stock has also been sold locally to finance plant extensions.

From July 1, 1919, to June 1, 1920, Mr. Locke sold $160,000 of the 7 per cent stock at par, and, including the former bondholders, the company now has 181 holders of preferred stock with an average investment of over $1,400 apiece. None of the stock was sold on time payment, and the field of the small investor who buys five shares or less has scarcely been touched. The books of the company do not show any expense for this financing because so far it has simply meant that when the company needed money Mr. Locke went out and sold some more stock.

Mr. Locke says that if a community needs public

utility service the people who are to be served should provide the necessary capital. However, the utility should be well managed and conservatively financed. The property at Mexico, Mo., was appraised at over $500,000 in 1915, and, based on pre-war costs, the minimum value of the property by this fall will equal the par value of the outstanding securities, consisting of $400,000 preferred stock, $300,000 common stock and $50,000 in notes. The net earnings are about three times the dividend requirements of the preferred stock.

Maine Company Instructs Employees Through Weekly Bulletins

OVER the signature of the general superintendent the Central Maine Power Company, Augusta, Maine, publishes in its weekly house organ, *The Exciter*, interesting and instructive information for its employees. The articles appear under an official heading and discuss a different topic each week. Following is a typical specimen of one of the official bulletins:

Do not condemn the meter or assume that it is out of calibration when your customer complains of his bill being too high. The meter ninety-nine times out of a hundred is all right.

When a customer complains about his account, take steps to show him that the meter is right and that he is actually using all of the energy shown on the dial. This can be accomplished by a very simple test, so that the customer can also understand and see that the meter is correct.

When a customer claims that he is being overcharged, do not try to remedy the matter by telling him that you will take his meter out and put in another one. This is the equivalent to admitting that he is justified in his complaint and is not only an injustice to the meter, which may be all right, but detrimental to your own interests.

It is very rarely that an electric meter runs too fast, and this is found to be so only about once in every forty complaints.

It is the duty of the customer to watch his lights and see that none of them are turned on when not needed, or in use in out-of-the-way places where they are often forgotten.

GEORGE S. WILLIAMS,
General Superintendent.

How a Power-Factor Penalty Works in Boston

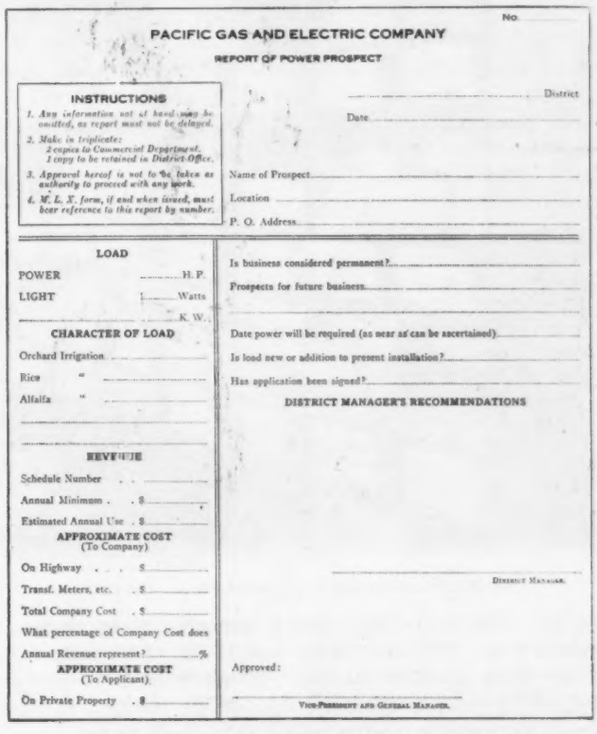
ALL CONTRACTS of the Edison Electric Illuminating Company of Boston for power of 50 kw. demand or over carry a power-factor penalty, stated R. S. Hale recently before the New England Section of the National Electric Light Association. The company's experience in enforcing the penalty is, on the whole, satisfactory. A fair number of customers who come under this rate operate so as to keep their power factor at the time of their demand above 80 per cent, this result being due to the careful selection of motors and careful operation. In a few cases the customers have put in correcting apparatus. In perhaps half of the cases the power factor at the time of the maximum load is less than 80 per cent, which results in their paying a penalty in that the company charges them 80 per cent of the kva. in such cases instead of the true kilowatts.

"There is one objection to it in my mind," said Mr. Hale, "in that our present method of determining the billing demand is the average of 150 readings, which involves the computing of the power factor for each reading, resulting in considerable figuring, although the expense is small in proportion to the total bills of these fairly large customers. We have in mind a change whereby the power factor will be assessed against the average power factor and not against the power factor at the time of the maximum demand. While theoretically this is not right, investigation of a number of cases indicates that in practice it will work out even better than our present method, and in addition will be very much simpler to apply. We measure the power factor now by a watt-hour meter connected so that the phase angle is just 90 deg. away from connections of the ordinary watt-hour meter.

"In our new method we shall have merely a reading of the so-called kilo-reactive-watt-hour meter once a month. We shall then provide that for, say, every 100 kw.-hr. the customer may have, say, 75 k.r.w.-hr. without paying a penalty, this corresponding to the average power factor of, say, 80 per cent. We would then provide that for any excess kilo-reactive-watt-hours above the specified minimum allowed free there should be a charge of so many mills per k.r.w.-hour, or else the k.r.w.-hours over and above the minimum should be considered as the equivalent of, say, one-fifth their number of kilowatt-hours, and this number of kilowatt-hours should be added to the number of kilowatt-hours on the kilowatt-hour meter."

Power "Prospect" Form Saves Useless Work

TO SAVE the time and labor involved either in making up a detailed estimate for an extension to a consumer that might not meet the approval of the head office or in getting the terms on which the company would make the extension, the Pacific Gas & Electric Company has evolved a preliminary form that



No. .....

PACIFIC GAS AND ELECTRIC COMPANY

REPORT OF POWER PROSPECT

INSTRUCTIONS

1. Any information not at hand may be omitted, as report must not be delayed.
2. Make in triplicate: 2 copies to Commercial Department, 1 copy to be retained in District Office.
3. Approval hereof is not to be taken as authority to proceed with any work.
4. W. L. X. form, if and when issued, must bear reference to this report by number.

..... District

Date .....

Name of Prospect .....

Location .....

P. O. Address .....

LOAD

POWER ..... H. P.

LIGHT ..... Watts

..... K. W.

CHARACTER OF LOAD

Orchard Irrigation .....

Rice " .....

Alfalfa " .....

.....

.....

REVENUE

Schedule Number . . ..

Annual Minimum . . $.....

Estimated Annual Use . $.....

APPROXIMATE COST
(To Company)

On Highway . . . $.....

Transf. Meters, etc. . $.....

Total Company Cost . $.....

What percentage of Company Cost does Annual Revenue represent? .....%

APPROXIMATE COST
(To Applicant)

On Private Property . $.....

Is business considered permanent? .....

Prospects for future business .....

.....

Date power will be required (as near as can be ascertained) .....

Is load new or addition to present installation? .....

Has application been signed? .....

DISTRICT MANAGER'S RECOMMENDATIONS

.....

District Manager.

Approved:

.....

Vice-President and General Manager.

PRELIMINARY FORM FOR SERVICE EXTENSION

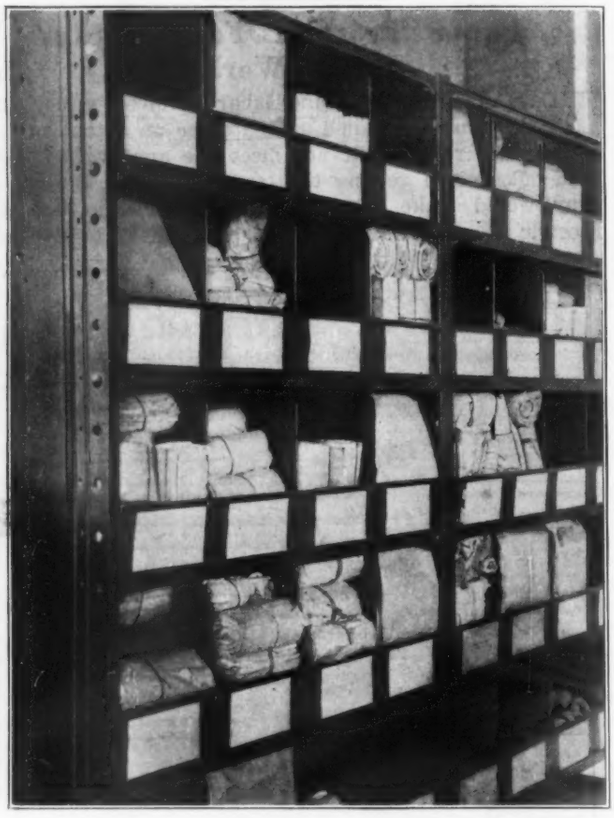
can be filled out with very little labor but which shows the size and character of the load, revenue and approximate cost to the company and the consumer. This form is filled out by the district manager of the

company and sent to the head office for approval by the commercial manager and the general manager. The form is sent back to the district manager within twelve hours, and he is then able to close the contract with the prospective consumer before the latter has had an opportunity to change his mind. Another advantage of this form is that where a local manager is able to anticipate a consumer's call he can, by filling out the blank and receiving its approval from the head office, close the transaction as soon as the consumer comes in.

The old form, containing detailed information on the extension, number of poles, insulators and all other items of material and labor, is filled out after the "prospect" form has been approved and is sent in to the engineering department. This system saves time to the consumer, and helps the local offices.

Industrial Power Charts Stored Compactly

WHAT to do with the recording-meter charts obtained on the premises of large power customers is a question that the New England Power Company has solved acceptably by the steel cabinet illustrated herewith. At its Greendale substation the company has a cabinet 6 ft. (1.83 m.) long, 64 in. (1.62 m.) high and



STORAGE CABINETS FOR INDUSTRIAL CHARTS

24 in. (0.61 m.) deep, which contains forty compartments 9 in. (23.8 cm.) wide and 12 in. (30.5 cm.) deep, with front barriers 3½ in. (8.9 cm.) high to prevent rolling of records upon the floor. The cabinet, of sheet steel, is provided with adjustable shelf holes and is framed with 1⅝ in. x ⅞ in. x 1 in. (4.15 cm. x 2.2 cm. x 2.5 cm.) angles. Within this small space from 500 to 1,000 bundles of charts can be stored, depending upon size, and concentrating the records of customers within a radius of 10 miles to 15 miles (16 km. to 24 km.).

Coal Contract Should Be Based on Unit Cost of B.T.U.

ALTHOUGH many companies have been forced recently to buy coal without any very definite assurance as to its heat value, they should properly pay only for the heat value received. This is commonly done by specifying in the contract a certain number of B.t.u.'s which are to be delivered for 1 cent. The contract guarantee is based on some given analysis, such as 5 per cent moisture, 11.5 per cent dry ash, 13,000 B.t.u. per pound (1,480 cal. per kg.) of dry coal, and a price of $3 per ton. The guaranteed B.t.u. for 1 cent is then obtained in the following manner: Reduce the B.t.u. per pound by a percentage equal to that of the moisture in the coal. In this particular case the moisture is 5 per cent, and 95 per cent of 13,000 B.t.u. equals 12,350 B.t.u. per pound (1,210 cal. per kg.) of coal as delivered. Multiply this figure by 2,000 lb. (907 kg.) and a figure of 24,700,000 is obtained, which is the total B.t.u. per ton as delivered. Divide this by the contact rate per ton expressed in cents plus one-half of the dry ash percentage expressed in cents. In this particular case the divisor will be 300 + ½(11.5) or 305.75. It follows then that the net B.t.u. for 1 cent, according to this contract, would be 80,785.

Suppose the coal as delivered, instead of having the analysis given in the contract, has 6.5 per cent of moisture, 11.9 per cent of dry ash and only 12,886 B.t.u. per pound (1,470 cal. per kg.) of dry coal. The total B.t.u. per ton as delivered are figured out in the manner shown above, and the result is 24,098,000. This figure is divided by 80,785, which is the guaranteed net B.t.u. for 1 cent. The result would indicate that the coal dealers should be paid $2.98 per ton. However, the dry ash amounts to 11.9 per cent, and half of this percentage in cents, or virtually 6 cents, must be deducted from the $2.98 to offset the decrease in burning efficiency due to the presence of ash. The $2.98 minus 6 cents leaves $2.92, which is the amount per ton which should be paid the dealer.

Providence Company Establishes House-Wiring Records

MORE meters for house wiring have been set so far this year by the Narragansett Electric Lighting Company, Providence, R. I., than were placed in the entire year 1919. Up to June 10 1,527 meters were set for all services, and of these 1,326 were in houses. The average price on 986 contracts analyzed was $154.50, and the average number of outlets on the first seventy-seven jobs, which the company states are typical of all, was 14.5. Last year the average price of each house-wiring job was $146. An active advertising campaign is being conducted in the local press. This year the work is done at a cash price, the former 10 per cent allowance of the central station for carrying the account after the contractor completed the job having been eliminated. To offset this reduction, the time to complete all payments by the customer has been reduced this year from twenty-four to eighteen months. A payment of 10 per cent down is required on each contract, with monthly installments thereafter. Recently there has been such a shortage of meters and service boxes at Providence that the company has been supplying many new customers on the basis of estimated monthly bills.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
of the World

Generators, Motors and Transformers

Predetermination of the General Dimensions of Electric Machinery.—H. DE PISTOYE.—This article contains a number of general theorems regarding the relations between output and certain general dimensions such as rotor diameter, iron length, width of air gap, speed, etc. It is shown, for instance, that for geometrically similar machines, with the same angular velocity of rotation, the output varies as the 3.5 power of the linear dimensions. In another theorem the author states that the air gap must be increased in a ratio proportional to the 1.5 power of the linear dimensions in order that geometrically similar machines shall have similar no-load characteristics, at the same percentage of excitation ampere turns. A general formula is derived, which shows the most economical relation of diameter to axial length for rotating machinery.—*Revue Générale d'Electricité*, Jan. 24, 1920.

Lamps and Lighting

Walls and Floors—Their Effects on Lighting.—VAN RENSSELAER LANSINGH.—This paper gives the utilization factors of several different units of the direct, semi-indirect and totally indirect designs for the gas-filled lamp when tested under varying conditions of walls and floor. An interesting table giving the reflection factor of trim, ceiling, floor and wall coverings follows:

	Per Cent Reflection Factor
Trim:	
Ivory white	47
Floors:	
Average of dark and light cork squares	17
White paper	55
Black cloth	2
Walls:	
Sand color	31
Brown shades	11
Green shades	11
Grey mat paper	22
White paper	55
Ceiling:	
Cream white	52

The effect of variable wall and floor coverings with their interaction is also analyzed.—*Transactions I. E. S.*, March 20, 1920.

Arc Lamp with Rotating Arc.—GARBARINI.—This lamp is especially designed for use with optical systems where a source of light of small dimensions, high brilliancy and great constancy is required and where the position of the luminous point must be fixed in space. Only the positive electrode is made of carbon, the other being a metal ring, which is water-cooled and surrounds the end of the carbon, so that the length axis of the carbon coincides with the axis of the ring. Concentrically with respect to the ring there is a coil of several turns, passed by the arc current. This coil gives rise to a magnetic field, which always cuts the arc at right angles, thus causing the arc to rotate with very great speed around the end of the positive electrode, which will be heated in a perfectly even manner to a white glow. A special feeding mechanism is provided, which keeps the end of the carbon at a given position with respect to the ring electrode.—*Bulletin Officiel de la Direction des Recherches et des Inventions*, No. 3, January, 1920; abstracted in *Revue Générale d'Electricité*, April 19, 1920.

Generation, Transmission and Distribution

Electric Power in Holland.—This article gives a map showing the network of high-tension transmission lines in Holland and also some information regarding the generating plants. The increased use of electrical energy in Holland in recent years is given in the following table:

	Maximum Load, Kw.	Total Consumption, Kw.-hr.
1913	45,600	114,000,000
1914	53,600	134,000,000
1915	69,600	173,000,000
1916	88,400	221,000,000
1917	90,000	216,000,000
1918	100,000	240,000,000

The scheme of locating generating plants at the coal mines has been considered, but it is said that the advantages of centralization still prevail.—*Electrical Industries* (London), May 26, 1920.

Grounding of Electric Machinery and Installations.—J. DAMIEN.—The author cites the French rules regarding grounding of electrical installations and criticises their vagueness in wording. Advantages and disadvantages of different methods of grounding are briefly discussed, and some practical suggestions are given. According to regulations of the French marine, the grounding conductor should be "a copper conductor with as few bends as possible. Its section to be computed on the basis of 1 mm.^{2} (1,970 circ.mils) per 10 amp. normal current of the machine to be protected, but with a minimum area of 10 mm.^{2} (19,700 circ.mils). The Verein Deutscher Ingenieure has adopted the rule that the grounding resistance should be less than $50/I$, where I is maximum short-circuit current. Assuming that $\sqrt{L/C} = 70$, this corresponds, in an alternating-current case, to a resistance of grounding less than $3{,}500/E$, where E is the line voltage.—*Revue Générale d'Electricité*, Jan. 24, 1920.

Traction

Modern Devices and Control for Automatic Railway Substations.—CASSIUS M. DAVIS.—This article deals with the improvements which have been made in the controlling devices and describes in detail the automatic operation of the substation, including the starting up, shutting down, protection and adjustment of the equipment.—*General Electric Review*, April, 1920.

The Auxiliary and Lighting Control Equipment of the Chicago, Milwaukee & St. Paul Locomotives.—JOHN

A. CLARKE, JR.—From the locomotive cab must be supplied the means by which speed is regulated, the heat for the train and in this case light for the train as well. For this auxiliary service a 35-kw. motor-generator set was chosen, together with a 378-amp.-hr. storage battery. The battery floats across the terminals of the generator, assisting it on the peak loads and receiving charge when the load is light. In addition there are two 40-kw. axle-driven generators mounted on the bogie trucks. They are used to supply current for the traction motor fields during regeneration. The details of this auxiliary system are given in the article. —*Electric Journal*, June, 1920.

Installations, Systems and Appliances

A New Type of Gathering Locomotive.—JOHN LISTON. —The gathering locomotive is said to be one of the most important factors in securing a high per capita output in mines, and its development and refinement have been the subject of continuous study by both mining engineers and electrical manufacturers. The particular type covered by this article embodies the latest developments by one company for the attainment of a positive and simple system of control which, it is said, makes it possible to secure maximum operating economy.—*General Electric Review*, May, 1920.

Automatic Protective Devices for Alternating-Current Systems.—A. E. MCCOLL.—A broad discussion of relay protective schemes, particularly those of modern origin, according to electrical practice in Great Britain. —London *Electrician*, May 21, 1920.

Arc-Welded Building Construction.—Arc-Welded trusses for a one-story building covering approximately 22,000 sq.ft. (2,100 sq.m.) are reported to have been used at Brixton, England. Details of the assembly of the trusses are given in the article.—London *Engineer*, May 14, 1920.

Units, Measurements and Instruments

The Thermal Storage Demand Wattmeter.—PAUL M. LINCOLN.—The thermal storage demand meter developed by the author is discussed as a means of determining maximum demand for rate purposes. It is compared with other methods of accomplishing this purpose and the characteristics of these several methods are enumerated.—*Electric Journal*, June, 1920.

Instrument Transformers.—R. S. J. SPILSBURY.—A discussion of the design and characteristics of current transformers, including the consideration of accuracy and methods of testing for ratio and phase angles.— *Beama*, May, 1920.

Measuring Large Direct Currents at a Distance.—H. RING remarks upon the article of Besag on this subject (recently referred to in these columns) that a distance indicator for large continuous currents was devised by him as early as 1913. The apparatus works as follows: A small induction or synchronous motor drives a little direct-current generator, which is compounded by a one-turn winding connected across a shunt in the direct-current bus. The voltage of the dynamo may be measured at any distance and is a function of the direct-current strength in the compounding turn, which makes it possible to calibrate the voltmeter directly in terms of current in the bus. The interesting point of the system is that a negative compounding is used. When the compounding current increases the generator excitation thus diminishes, but never so far down that any considerable indefiniteness is caused by hysteresis in the iron. The magnetic induction of the core will describe a very narrow, unsymmetrical hysteresis curve, and errors due to hysteresis may be kept down to 1 or 2 per cent.—*Elektrotechnische Zeitschrift*, Jan. 29, 1920.

Telegraphy, Telephony and Signals

Simultaneous Transmission and Reception in Radio-Telephony.—NOBURO MARUMO.—After reviewing the methods of duplex radio communication previously proposed, the author describes a divided branch antenna arrangement with supplementary balancing coil for this purpose. The theory and mode of adjustment of the system are explained. The application of this method in practice to ship-to-shore radio-telephony is described, and reference is made to the necessary wire-to-radio and reverse transfers. Guided radio telephony and telegraphy over high-tension transmission lines is considered. The use of a single oscillation generator for a number of stations is shown to be possible. An actual transmission of this type is described in detail.—*Proceedings of the Institute of Radio Engineers*, June, 1920.

Carrier-Wave Telegraphy and Telephony. — FASSBENDER and HABANN.—We have already in these columns (Feb. 7, 1920) briefly referred to the system of multiplex-wire telephony and telegraphy with high-frequency carrier waves which was developed in Germany during the war. In the present article the original authors of this multiplex system give a detailed account of the more important features of the system and describe the various types of connections employed. In the multiplex telephony an important point is the use of ordinary audio-frequency transmission from subscriber to exchange, the carrier-wave transmission being resorted to only for long-distance trunking service. Carrier waves in the radio range are used, corresponding to wave lengths between 1,000 m. and 2,000 m. During silence the modulator does not generate any high-frequency waves, but when the effective plate or grid voltage of the modulator bulb is boosted by induced alternating emfs. from the microphone circuit, conditions change so that sustained oscillations build up, their amplitude depending on the instantaneous value of the impressed sound waves. A difficulty with multiplex is the tendency of the call currents to operate all bells on the system. It is claimed that this has been overcome by use of carrier-wave transmission also for call currents, although the details of this system are omitted. The multiplex telegraphy depends on interference reception with telephones, one transmitter at the sending end giving audible beats with a certain transmitter at the other end of the line. Morse inker reception also has been successfully tried, the necessary audio selectivity being provided by special mechanically tuned polarized relays. The system also proved adaptable for high-speed operation in multiplex by means of Hughes' and Siemens' machine telegraphs, etc. —*Jahrbuch der drahtlosen Tel. und Tel.*, October, 1919.

Miscellaneous

Steel-Mill Electrical Repair Shop Practice.—A. J. STANDING.—The writer states that it has been proved that the majority of repair work can be handled to better advantage in the steel-mill repair shop than by contracting it out. He then discusses just what is necessary in the way of equipment, force and methods of handling the general plant electrical repairs.— *Proceedings Association Iron and Steel Electrical Engineers*, April, 1920.

Books of Technical and Industrial Interest

ROBISON'S MANUAL OF RADIO TELEGRAPHY AND TELEPHONY. By Capt. S. S. Robison, U. S. N. Annapolis, Md.: United States Naval Institute. 308 pages, 144 illustrations.

This is the fifth revised edition of a well-known manual of radio communication intended primarily for the use of operators in the United States Navy, but incidentally well adapted to the needs of student radio operators generally. It is an elementary textbook on radio-telegraphy and radio-telephony. It is brought up to date in a number of particulars. A valuable feature of the book is that it contains much practical information concerning the radio circuits and apparatus employed in United States naval stations. For example, a full list is given of 140 United States naval stations and also of fifty radio-compass stations, at which electric goniometric measurements can be made. The book is divided into seventeen chapters relating to the following subjects: High-frequency currents, waves, electric units, capacity and inductance, power and efficiency, transmitting apparatus, continuous-wave transmitters, radio-telephones, receiving apparatus, antennas, high-power stations, radio compass, aircraft radio, installations, care and operation, tables, laws and regulations. The book is practical, easy to understand and free from all but the simplest mathematics. It is well adapted to the purposes the authors have held in view. It could be improved by a page index of subjects.

ELECTRIC OSCILLATIONS AND ELECTRIC WAVES. By Prof. G. W. Pierce. New York: McGraw-Hill Book Company. 517 pages, illustrated. Price, $5.

Prof. G. W. Pierce's new book on "Electric Oscillations and Electric Waves" is remarkable in more than one respect. It has so much of the personal touch of the active research man and gives so much of the author's recent original contributions to the art that it should not be classified as a mere textbook; and still it is a textbook in the highest sense of the word. The book does not cover the entire field of radio engineering, nor does it pretend to. Instead, three or four of the most difficult and advanced problems in this field are taken up for the very thoroughgoing analysis. In each case the theory is built up step by step from the very rock bottom of mathematical physics and successively developed into a form where the results may be applied to problems of practice. The first half of the book deals with the theory of electric oscillations in coupled circuits. After some introductory chapters devoted to fundamental notions of electricity, use of complex algebra in the treatment of alternating-current circuits and so on, the simple oscillating circuit is studied; then the mutual reaction between two coupled circuits is taken into consideration, and finally the extremely complicated problem of three coupled circuits is attacked. In the last part of the volume the theory of electromagnetic waves is developed from the fundamental field equations, and on the same basis the radiation field of an oscillating dipol is analyzed. By means of an ingenious device, equivalent to a superposition of a number of infinitesimal dipols, the theory is extended to oscillators of finite dimensions and in the last few chapters is applied to the problem of computing the radiation characteristics of flat-top antennas. Every chapter of the book shows the author's decision to present a mathematically rigid theory, based, however, on physical conceptions rather than mathematical symbolism. An outstanding feature of the volume is its conciseness in the use of symbols and units and its definiteness in stating the reasons for successive steps in the mathematics. After every more important development there is given, in italics, a clear statement of the physical significance of the results, of the approximations made, etc., and of the methods to be used in order to extend the results to new fields of application.

SERVICE AT COST PLANTS. By Harlow C. Clark, editor of *Aera*. New York: American Electric Railway Association.

This "identical analysis of statutes, ordinances, agreements and commission orders, in effect or proposed, together with a discussion of the essentials of local transportation franchises," contains, first, a consideration of the fundamentals which must, if private capital is to be obtained, underlie any expression of legal right to conduct a local transportation utility; second, an analysis of the various measures, with the idea of ascertaining the extent to which such principles have been applied; third, an identical analysis of the "cost of service" plans now in effect, similar provisions bein grouped together in order that the provisions coverir any particular point may be quickly ascertained, ar fourth, a similar analysis of "service at cost" plans pr posed but not effective. Although confined to electr railways, there is much in the principles of valuatic and rate of return discussed that has also an applic tion to central station and other utilities.

Books Received

MOTOR VEHICLE ENGINEERING. By Ethelberg Favary. New York: McGraw-Hill Company, Inc. 333 pages, 133 illustrations.

ELECTRICAL MACHINERY. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 318 pages, 302 illustrations.

TELEPHONE TRANSMISSION. By J. G. Hill. London, England: Longmans, Green & Company. 398 pages, illustrated. Price, $6.50.

INVENTIONS, THEIR DEVELOPMENT, PURCHASE AND SALE. By William E. Baff. New York: D. Van Nostrand Company. 230 pages. Price, $2.

THE ORGANIZATION OF INDUSTRIAL SCIENTIFIC RESEARCH. By C. E. Kenneth Mees. New York: McGraw-Hill Book Company, Inc. 175 pages. Price, $2.

ELECTRICIAN'S HANDYBOOK. By T. O'Connor Sloane. New York: Norman W. Henley Publishing Company. 824 pages, 600 illustrations. Price, $4.

TRANSIENT ELECTRIC PHENOMENA. By Dr. C. P. Steinmetz. New York: McGraw-Hill Book Company. 696 pages, illustrated. Price, $6.

SCHOOL OF PRACTICAL ELECTRICITY. Book II. Fundamentals of Continuous Currents of Electricity. By O. Werwath. Milwaukee, Wis.: Electroforce Publishing Company. 134 pages, 90 illustrations.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

VOLUME of business for all classes of electrical material shows no decrease in the East and South, but a noticeable diminution of demand is reported from the Middle Western and Northeastern sections, attributable to summer dullness.

TRANSPORTATION has improved, especially in Chicago and Boston, and more goods are being shipped by express. Collections on the Western coast are in better shape than in New England or the South. Building activities are slackening in the West, but a good total of new construction is reported in Eastern states.

COMPARATIVELY cool weather is retarding the sale of fans. There is a marked shortage of rigid conduit, but armored conductor is coming through in better shape except in New York. Porcelain is scarce. Fair stocks of loom are accumulating. In general the market has held steady. Stocks of carbon brushes are good. The market for stranded steel wire remains steady, and manufacturers are having difficulty in meeting orders.

CARE on the part of men associated in the electrical industry is urged in view of a federal court's action under the Sherman act in enjoining member companies of the American Hardwood Manufacturers' Association from exchanging information bearing on their stocks and prices.

FIGURES for the winter of 1919-1920 show a heavy sale of electric heaters, surpassing all previous seasons. Business in the coming season promises to be good in all sections of the country, though large stocks were carried over by jobbers in the South.

A DECISION upholding the Coolidge wrought-tungsten patent, in the suit for infringement brought by the General Electric Company against the Independent Lamp & Wire Company, has been handed down in the United States District Court.

A POWER HOUSE that will operate under a head of 2,400 ft., probably the highest in the United States and among the highest in the world, is to be built on the Stanislaus River in California by the Pacific Gas & Electric Company on the property acquired from the Sierra & San Francisco Power Company. This plant will be rated at 7,500 kw. A third penstock is being installed on the present Stanislaus plant to increase its efficiency.

SWITZERLAND has issued $25,000,000 in 8 per cent twenty-year government gold bonds as part of a program for the gradual electrification of her railway systems. It is announced that the entire proceeds will be used in the United States.

ELECTRICAL engineering schools are unable to meet the demand for technical graduates, according to a report made at the Ann Arbor meeting of the Society for the Promotion of Engineering Education.

NEGOTIATIONS between Springfield, Ill., and the Springfield Gas & Electric Company for the purchase of the company's electric light and power and heating properties by the city have been renewed.

AN OFFERING of $1,000,000 of 7 per cent cumulative preferred stock on the installment plan is being made to the public by the Alabama Power Company.

A TRANSMISSION line from Gadsden, Ala., to Lindale, Ga., a distance of 52 miles, is to be built to connect hydro-electric systems of those states.

A FIVE-YEAR course in business engineering will be inaugurated this fall at Harvard University, through the co-operation of the Harvard Engineering School and the Graduate School of Business Administration.

THE ANNUAL report of the Pacific Gas & Electric Company shows that three-fourths of its stockholders are residents of California. It announces an increase in the price of fuel oil in six years amounting to more than 128 per cent.

A RECORD price of $23 a ton was paid for coal a few days ago in Boston Harbor, against a maximum war-time price of $13. Public Utilities Commissioner Ellis of Massachusetts asserts that 400,000 tons are being sent abroad monthly at the peril of a fuel famine in New England next winter.

OPPOSITION to compulsory arbitration of private industrial disputes is expressed in the platform adopted by the Democratic National Convention, which, however, holds that in government service the rights of the people are paramount to the right to strike. The Mississippi and St. Lawrence waterways are indorsed and an increased supply of petroleum is declared a necessity.

A SPECIAL two weeks' "short course for metermen" was conducted by the University of Illinois from June 21 to July 3.

W. S. MURRAY has been appointed chairman of the engineering staff to make an investigation and report in the matter of the super-power survey between Boston and Washington. He will work with an advisory board representing engineering, railway and technical-publication interests and the N. E. L. A. and other organizations.

THE COAL situation remains highly critical. The smaller utilities are in the worst shape, being largely without proper reserves.

OSCAR C. MERRILL, chief engineer of the United States Forest Service, has been appointed chairman of the newly created Federal Power Commission and has begun to shape the procedure of that body.

MAJORITY stock ownership of the public utilities in Maine controlled by Maynard S. Bird and Hugh J. Chisholm has been acquired by the Central Maine Power Company.

REPORTS received by the Geological Survey from 350 electric utility plants showed a total bituminous-coal supply on May 31 of 1,372,880 tons, or a supply for three weeks and three days.

MINNESOTA is planning a state federation of Engineering societies.

A PRIORITY order for 12,000 tons of bituminous coal has been granted by the Interstate Commerce Commission to the Philadelphia Electric Company.

THE WISCONSIN Industrial Lighting Code has been put into effect for all existing installations. Hitherto it has applied only to new installations.

A SUCCESSFUL "no accident week" campaign was held in several Pennsylvania counties under the auspices of the Penn Central Light & Power Company of Altoona.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Smaller Utilities in Worst Shape on Coal Supply

WHILE the immediate supply of coal for utilities is not altogether as short as it was a few weeks ago, there seems to be a very definite opinion that the open-top car order of June 21 has not relieved the situation very much. Among the smaller utilities the coal situation is most acute. Unless this condition is relieved before long, numbers of utilities, even if not forced to shut down, will enter the winter season with no reserve on hand. There is consequently a growing demand on the part of the utilities for coal priorities. A meeting to consider the entire coal question was scheduled for Thursday before the Interstate Commerce Commission in Washington.

In preparation therefor the National Electric Light Association, Executive Manager M. H. Aylesworth stated, wired to various parts of the country to operating members asking if this recent order of the I. C. C. had made any noticeable improvement in coal supply and also for information on the number of days' supply of coal on hand and asking for suggestions to be made to the commission. A number of replies were received, all of which, Mr. Aylesworth stated, indicated that the situation is still very acute, particularly among the smaller utilities all over the country. The replies further indicated, he said, that the open-top car order had improved the situation but slightly, and there seemed to be an immediate need for a priority order over the less essential industries if the utilities are to go into the winter with coal in storage. Generally speaking, Mr. Aylesworth pointed out, there is only enough coal on hand for immediate need.

The meeting this week is but one of a series to be held with the I. C. C. The electrical interests are to be represented by the National Committee on Gas and Electric Service, which has headquarters in Washington.

Insull Tells Why Commonwealth Edison Has Not Asked for Higher Rates

THE Commonwealth Edison Company has not as yet found it necessary to ask for any increase in rates because of increasing costs of doing business. In commenting on this situation, which is exceptional in the utility field, Samuel Insull, president of the company, said to a representative of the ELECTRICAL WORLD:

"While increased efficiency of equipment and its operation has played its part, there are two basic reasons for the situation, the first being the ownership by the Commonwealth Edison Company of its own sources of coal supply and the second the large amount of energy sold wholesale, 80 per cent of the output being so sold. By owning our own sources of supply we have been able to keep down the cost of fuel. Accounting, meter reading, customer service and the other forms of expense entering into the cost of service to the consumer are pratically as great for a small consumer as for a large one. Because of the large percentage of energy wholesaled to a comparatively few customers, our expense per unit has not risen so rapidly as it would have done had we been distributing this 80 per cent of our output to a large number of small consumers. The situation is the outgrowth of a consistent policy of a quarter of a century's standing in the development of ownership of our own fuel supply and the wholesaling of energy to the large consumer."

Merrill Appointed Executive Secretary Federal Power Commission

O. C. MERRILL

SECRETARY OF WAR BAKER, chairman of the newly created Federal Power Commission, has appointed Oscar C. Merrill, now chief engineer of the United States Forest Service, executive secretary of the commission. The first three official acts performed by Mr. Merrill following his appointment were the following: Formal presentation to the Solicitor of the Treasury of the questions pertaining to the employment of personnel of the power commission itself; formal inquiry of the War, Interior and Agricultural Departments as to what personnel is available for temporary transfer to the power commission, and request for appointment of an advisory committee to draft regulations under the act.

Complying with this last request, the War Department designated General Crowder to serve on the advisory committee, the Interior Department selected Herman Stabler and the Department of Agriculture named Mr. Merrill himself to look after its interests. It will require two or three months, it is believed, to draft the regulations.

Gen. Lansing H. Beach, the chief of engineers, has designated Major Max C. Tyler as the officer who will conduct the investigation of the Great Falls Power project and the matter of an additional water supply for the District of Columbia. The report on this investigation must be made to Congress on or before Jan. 1. An appropriation of $25,000 is provided for the work.

The selection of Oscar C. Merrill as executive secretary of the Federal Power Commission is regarded in Washington as a particularly happy one. So pre-eminent

were Mr. Merrill's qualifications for this position that the name of no other man was even suggested. The water-power act has its entire foundation in the water-power regulations drafted by Mr. Merrill to apply to water powers under the jurisdiction of the Forest Service.

Before entering the Forest Service in 1909 Mr. Merrill already had made a name for himself as a water-power specialist as a result of extensive private work in water-power engineering. Owing to the limited amount of work done by the government which pertains to water powers, Mr. Merrill has the distinction of being practically the only government engineer who could classify as a water-power specialist.

Mr. Merrill is a native of Maine. He was born in Manchester, near Augusta, in 1874. Most of his early education was obtained in Augusta, and in 1899 he was graduated from Bates College. His engineering education was obtained at the Massachusetts Institute of Technology, where he was graduated in 1905. While attending school he devoted his summers to work for the United States Geological Survey.

The first year following his graduation was spent by Mr. Merrill as an instructor in the engineer department in the University of California. He then became associated with Charles G. Hyde and began his specialization in water-power consulting work. He investigated the adaptability of power sites along the lines of the Southern Pacific in Oregon and in Washington, with the idea of their utilization in connection with a proposed electrification of sections of that railroad. Later, he made a general reconnaissance of such water powers in Oregon as might lend themselves to any scheme of railroad electrification. Following that work, he undertook, in association with Professor Hyde, the valuation of the power system of the California-Oregon Power Company.

Mr. Merrill began work for the Forest Service by making a special study of water powers in California. He soon became district engineer with headquarters in San Francisco. In 1910 he was placed in immediate charge of all water powers coming under the jurisdiction of the Forest Service. In 1914 he was ordered to Washington to become chief engineer of the Forest Service. In addition to his enlarged duties, he retained under his personal direction the matters pertaining to water powers. It was he who negotiated the important permits for the Southern California Edison Company, the Great Western and the Montana Power companies, in addition to handling the permits for numerous smaller developments.

Stocks of Coal on Hand at Electric Utility Plants

THE Geological Survey published this week preliminary figures showing the stocks of bituminous coal on hand at representative electric utility plants as of Feb. 29 and May 31, 1920, in net tons. Reports were received from 350 plants having a weekly consumption of 398,656 tons.

Stocks on hand on Feb. 29 amounted to 1,320,368 tons, or a three weeks and two days' supply, and on May 31 to 1,372,880 tons, or a supply for three weeks and three days.

The figures for May 31 ranged anywhere from a twelve weeks and three days' supply, reported by four plants in Montana and Washington, to a supply for one week and two days reported by eight plants operating in Virginia.

On the basis of the latest published figures the 350 companies reporting consume about two-thirds of the coal requirements of the electric utility industry. In view of the transportation situation it is doubtful if the stocks of coal on hand were materially increased during June over the figures reported. Furthermore, since these are average figures, it is reasonably certain that many utilities have a much lower supply than the above average.

Philadelphia Electric Gets Coal Priority

TO PREVENT a possible curtailment of electric light and power supply in Philadelphia the Interstate Commerce Commission on June 30 granted the Philadelphia Electric Company a priority order on the Pennsylvania and East Broad Top railroads for transportation of 12,000 tons of coal. The railroads were ordered to assign cars to the Rock Hill Coal & Iron Company for the transportation of the 12,000 tons of bituminous coal now above ground at the rate of twenty cars per day for twelve consecutive working days beginning July 1, excluding Sunday and legal holidays, in addition to and without regard to the existing ratings and distributive shares for the mines on these railroads.

Brighter Outlook for Public Utilities, Says National City Company

CONFUSION in the mind of the investor has been the greatest factor in holding back a merited improvement in the popularity of public utility securities as desirable investments, according to a statement issued last week by the National City Company of New York. The investor has not been sufficiently educated as to the merits of these securities and in associating all public utilities with some of the unfortunate street-railway situations has failed to realize the strong position of electric power and light companies, telephone companies and certain of the gas and traction properties. Concerning the status of electric utilities, the statement reads in part as follows:

Corporations furnishing power and light are enjoying unequaled prosperity. There has been an enormous increase in motor-driven machinery within the last few years. Ease of operation, the slight expense involved in the installation of power in the factory, the elimination of the dangers and labor incident to the operation of small steam or gas plants and the increasing cost of fuel and labor in the operation of such plants have resulted in a constantly increasing demand on the power companies to supply the energy.

Under old methods of power production the handling of fuel, firing and operation generally called for much heavy work and many laborers working in unpleasant surroundings. Now power is produced by mechanically perfected methods which eliminate a large part of the drudgery, and a considerable percentage of power is generated by hydro-electric plants. Large central stations have demonstrated their ability to produce and distribute power at such an economical unit cost that their position is permanently assured. The growth of cities and increased density of population is reflected in the growing demand for light. As an indication of the future growth of this business it has been estimated that there are now fourteen million homes in the United States still to be supplied with electric light.

More and more we find discriminating investors analyzing the public utility situation, and as a result there is an in-

creased interest regarding this class of securities. The field is one which requires careful study. It is one, however, which will repay the investor through liberal return and strong security. The power and light businesses have not approached the limit of their growth. The transportation business, through readjustments that must surely come, will also offer many attractive issues.

Before the war public utility securities issued by corporations of undoubted strength and based on strong values and earning power were sold on a basis to yield around 5 per cent to 5½ per cent. Now, with largely increased values and increased demand for the output, the same class of securities can be bought on a basis to yield from 7 per cent to 8 per cent. Investors are now turning to such issues, and we believe that it is only a matter of time when the yields will again approach lower levels.

Gas and Electrical Interests Get Together on Classification of Accounts

REPRESENTATIVES of the American Gas Association and the National Electric Light Association met at N. E. L. A. headquarters in New York on June 30 to discuss and agree upon the form of presenting certain classifications of accounts to the sub-committee of the National Association of Railroad and Public Utility Commissioners. This sub-committee is to report at the next annual meeting, which will be held next month.

Agreement was reached on several items, but final decision on the complete recommendation of the conferees was withheld pending receipt of further data and information from various parts of the country. The meeting was adjourned to be called again by the N. E. L. A. as soon as the data is at hand, which in all probability will be the first of the week.

Wisconsin Lighting Code Now in Effect for Old Installations

THE Wisconsin Industrial Lighting Code, which has been in operation for the past two years on new installations, went into effect July 1 on all existing installations. Some of the important requirements of the code are as follows: Adequate lighting of all working or traversed spaces of buildings or yards, uniform distribution of artificial illumination, shading of overhead lamps, reflector depth sufficient to provide a 14-deg. screening angle, and compulsory use for local lighting of reflectors covering the entire lamp.

The State Industrial Commission has stated that too shallow reflectors on overhead lamps do not necessarily have to be replaced, but that the requirements can be met by using bowl-frosted lamps, bowl-enameled lamps or an opal cap or shield.

Public Utilities Promote Successful "No Accident Week"

A SUCCESSFUL and effective "no accident week" was observed from June 6 to June 12 in the counties of Blair, Huntington and Mifflin, Pennsylvania, under the auspices of the Penn Central Light & Power Company of Altoona. J. F. Cole, superintendent of electric operation for this company, was chairman of the safety committee which promoted and arranged the campaign. The State Department of Labor and Industry co-operated in the work, supplying speakers and films. Films were also furnished by the National Electric Light Association, the General Electric Company and others.

The method of campaign included personal letters to organizations, churches, physicians, etc., as well as to every employee of the Penn Central company, "follow-up" letters and "accident prevention" posters, banners, "safety" buttons and tags. Publicity matter pertaining to the movement was furnished to newspapers with a combined daily circulation of 55,000. Rallies were held in the evenings at Hollidaysburg, Altoona, Tyrone, Juniata, Lewistown and Huntington. Employers gave hearty support, and work was often suspended to permit workmen to attend daytime exercises. A material reduction in the number of accidents in the communities taking part was reported for the week of the campaign, and the movement for safety received an impetus and awakened interest in quarters where it had previously aroused no response, or had even been regarded with suspicion.

W. S. Murray Heads Super-Power Zone Engineering Staff Investigation

W. S. MURRAY

THE appointment of W. S. Murray as chairman of the engineering staff to make an investigation and report in the matter of the super-power survey between Boston and Washington has just been announced by the United States Geological Survey, under the auspices of which the report will be made.

Prior to his appointment Mr. Murray recommended a plan for investigation which has since been approved by the Survey, whereby the work is to be divided into three departments—one of railway investigation, one of industrial investigation and one of power and transmission investigation, and men of known experience in these fields are about to be selected by Mr. Murray as chiefs in charge of the three respective divisions. In addition there will be selected for the staff a secretary-engineer whose duty will be the collaboration of the field data and preparation thereof for the report text. The organization is to be further supplemented by the necessary assistants.

Mr. Murray further suggested that, in order to secure interest of power producers, power consumers and the nation as a whole (the last named standing behind the establishment of a national power policy), a board in an advisory capacity be created of men representative in the above-mentioned classes. To that end the following will be represented: (1) Engineering, (2) railways, (3) technical publications, (4) the National Electric Light Association and others associated organizations consistent with not too large a board. Already acceptances have been received from Prof. L. P. Brackenridge, head of the department of mechanical engineering at Yale University, representing engineering; James H. McGraw, president McGraw-Hill Company, Inc., representing the technical publications, and F. G. Buckland, vice-president New York, New Haven & Hartford Railroad, representing the railroads. In addition, Dr. George Otis Smith, director of the Geological Survey, and Mr. Murray will serve upon the board.

Mr. Murray will call meetings of this board at periods of not less than every two months, on which occasions the progress of the engineering staff will be stated so that the board may be informed upon what has been done and proposed procedure and thus secure from the general board its counsel and advice in the development of the investigation.

Mr. Murray has established engineering headquarters in New York City at the Buckley-Newhall Building, 709 Sixth Avenue. Announcement is expected soon of the completed organization for the investigation. The Geological Survey will be represented on the engineering staff by N. C. Grover, chief hydraulic engineer of the Survey, and the Bureau of Mines by its chief mechanical engineer, O. P. Hood.

Manufacturers Ask Increased Rate for Public Utilities

REALIZING that a cessation of public utility development would hamper the business and industry of the state, John M. Glenn, secretary of the Illinois Manufacturers' Association, recently addressed the following communication to the Public Utilities Commission of Illinois:

"Several months ago the Illinois Manufacturers' Association urged action on your part in reference to authorizing the utility companies of Illinois to change their rates to meet changed conditions. A great many industrial plants are dependent upon the services of these companies for power, fuel, light, communication and transportation. Poor service makes bad manufacturing conditions. The cost of materials, labor, transportation and other items included in production have so increased that it is absolutely essential that gas rates, electric light rates, telephone rates and street-car fares be increased or some other method adopted that will enable those who manage such properties to make both ends meet. Blood cannot be squeezed out of a turnip."

Asks $40,000 to Investigate Alaska's Water Powers

IN ADVISING the Secretary of the Interior what it is necessary to do to stimulate development in Alaska, the Alaska Advisory Committee makes, among others, the following recommendation:

"The committee finds that there are extensive water powers in Alaska and that the exact information about them is exceedingly meager. These water powers are important to the development of the mining, cannery and pulp-wood industries. The only investigations made of the water powers are carried on by small allotments made from the appropriations for the investigations of the mineral resources of Alaska, thereby decreasing the funds available for other important surveys of mineral wealth. The committee therefore recommends that Congress be asked for an appropriation of $40,000 to investigate the water resources of Alaska with reference to their use in mining, wood pulp and other industries."

Pacific Gas & Electric Gets 15 per Cent Rate Increase

ON JULY 1 the California Railroad Commission announced that a rate increase of 15 per cent had been allowed the Pacific Gas & Electric Company. This increase will take the form of a surcharge to be added to bills between July 10, 1920, and April 10, 1921. It is estimated that the gross income for the nine months noted will be increased $2,200,000 by this additional rate.

Harding Shows Knowledge of Utility Problems

WARREN G. HARDING, Republican nominee for the presidency of the United States, seems to realize the fundamental principles upon which the government regulation of public utilities is based. When speaking before a gathering of electric railway men in Chicago last January on the subject of electric transportation and the industrial situation at that time, Senator Harding said:

"I believe in strictest regulation without conflicting authority because all public utilities must yield to the voice of public interest; but the same power that protects the public must protect the public servant, whether that servant is capital or the workman who operates the utility.

"Destroyed credits must be restored and flexible scales of charges must be provided, so that a public may pay justly for that which it demands. The exploitation of ten or twenty years ago justifies no failure in good faith today. The public which is served has an obligation no less than that of those who serve it."

Minnesota Planning State Federation for Engineering Societies

THE organization of a body that would have greater power and more definite representative functions than the present Minnesota Joint Engineering Board was considered at a meeting in Duluth, Minn., on June 19, to which all Minnesota engineers were invited. A committee composed of the present Joint Engineering Board and a representative of each engineering society was appointed to work out a detailed plan looking toward the organization of a state federation of societies. The committee's report is to be submitted not later than Nov. 1.

Central Maine Power Acquires Smaller Properties

ACQUISITION of a majority of the stock issues of the public utilities controlled by Maynard S. Bird of Portland, Me., and Hugh J. Chisholm of New York by the Central Maine Power Company has recently been announced by the Maine Public Utilities Commission. Stockholders in these corporations, which include the Oxford Electric Company, furnishing light and power in Norway and South Paris; the Interurban trolley line between Augusta and Lewiston and the light and power company serving Rockland, Thomaston and near-by towns, have received in exchange shares in the Central Maine Power Company.

Stockholders are receiving every reasonable assurance of the advisability of this merger in order to provide additional power facilities of transmission and utilization on the numerous corporations and municipalities now being served by the Central Maine Power Company. A much heavier capitalization by the power company will be necessary, and petition for authority to make such issue was included in the petition to the commission and was readily granted.

Swiss Loan of $25,000,000 for Railroad Electrification

ANNOUNCEMENT was made this week of the sale of $25,000,000 government of Switzerland twenty-year 8 per cent gold bonds, the entire proceeds of which are to be used in the United States, according to a statement to a representative of the ELECTRICAL WORLD by Lee, Higginson & Company, fiscal agents of the Swiss government. This loan is part of a program for the gradual electrification of the government railway system of Switzerland. The country has estimated waterpower resources of 2,700,000 hp., and the progressive utilization of this waterpower will effect large economies by substituting hydro-electric power for fuel, which Switzerland now has to buy at high prices.

Los Angeles Wants to Develop 139,800 Additional Water Horsepower

THE most important of the applications received by the California Water Commission in the month of June was that of the city of Los Angeles, which asked for a total of 1,400 second-feet of water from the San Joaquin River and its tributaries. The application calls for the erection of four power houses with a total capacity of 139,800 hp., divided as follows:

	Hp.
Power house No. 1, north branch	19,600
Power house, south branch	14,800
Power house No. 2	14,200
Power house No. 3 east branch	14,300
Power house, west branch	11,900
Power house No. 4	65,000
Total	139,800

Another application came from H. L. Jaskman, Eureka, for 9,000 second-feet from the Klamath River for power purposes, his plan being to store 150,000 acre-feet and develop 300,000 hp., to cost $20,000,000.

Democratic Platform Discusses Labor's Rights and Duties

DECLARING its opposition to the compulsory arbitration of private labor disputes, the Democratic national convention at San Francisco none the less announced: "With respect to government service, we hold distinctly that the rights of the people are paramount to the right to strike." "Labor, as well as capital," the platform declares, "is entitled to adequate compensation. Each has the indefeasible right of organization, of collective bargaining and of speaking through representatives of their own selection. Neither class, however, should at any time nor in any circumstances take action that will put in jeopardy the public welfare. Resort to strikes and lockouts which endanger the health or lives of the people is an unsatisfactory device for determining disputes, and the Democratic party pledges itself to contrive, if possible, and put into effective operation, a fair and comprehensive method of composing differences of this nature."

"That workers should participate in the formation of sound laws and regulations governing the conditions under which labor is performed, recognize and obey the laws so formulated and seek their amendment when necessary by the processes ordinarily addressed to the laws and regulations affecting the other relations of life," is another declaration of the platform.

Other pronouncements of the Democratic body on questions affecting industry are a demand for a Congressional survey of existing taxes," a reaffirmation of the traditional Democratic policy of tariff for revenue only, indorsement of the budget system, and a clause favoring amplification of the Federal Trade Commission's authority along the line of preventing the unfair use of patents in restraint of trade.

The platform recognizes "the importance of connecting the Great Lakes with the sea by way of the Mississippi River and its tributaries as well as by the St. Lawrence River," a clause of special interest to electrical men in view of the water-power possibilities.

Ohio Association Convention Program

THE program for the twenty-sixth annual convention of the Ohio Electric Light Association, to be held at the Breakers Hotel, Cedar Point, Ohio, on July 13 to 16, inclusive, has been announced as follows:

Tuesday, July 13, 10:30 a.m.—President's address; reports of officers and committees. 2:30 p.m.—Report of illumination committee, G. S. Merrill, chairman; address, "Taxation of Utilities," C. Dalton, Toledo Railways & Light Company.

Wednesday, July 14, 10 a.m.—Report of station-operation committee, Prof. Henry B. Dates, chairman; paper, "Operating Troubles," C. W. DeForest, Union Gas & Electric Company, Cincinnati. 2:30 p.m.—Report of transmission and distribution committee, W. E. Beaty, chairman; address by William McClellan, vice-president Cleveland Electric Illuminating Company.

Thursday, July 15, 10 a.m.—Report of new business cooperations committee: Lighting and merchandising section, C. G. Eichelberger, chairman; power and heating section, J. C. Matthieu, chairman. 2:30 p.m.—Report of meter committee, J. L. Wright, chairman; address by George H. Cushing, managing director American Wholesale Coal Association, Chicago.

Friday, July 16, 10 a.m.—Address, "Heat Treatment of Steel," R. T. Kaighan, Cleveland Electric Illuminating Company; round-table discussion on farm business.

It is planned to have the exhibits in the meeting hall this year. Entertainment for ladies accompanying delegates will be provided during the business sessions.

Closing of 52-Mile Gap to Give Southern Interconnection of 900 Miles

HYDRO-ELECTRIC power systems of Georgia and Alabama will soon be connected by a transmission line 52 (83 km.) miles long, extending from Gadsden, Ala., to Lindale, near Rome, Ga., according to an announcement made in Atlanta by officials of the Georgia Railway & Power Company. Joining of the power lines of the Alabama Power Company and the Georgia Railway & Power Company was urged by the War Department during the period when the power companies were under Government regulation.

The Georgia Railway & Power Company has connections already established with the Tennessee Power Company between Cleveland, Tenn., and Lindale, Ga., and with the Columbus Power Company at Newman, Ga., with the Central Georgia Power Company at Atlanta, and with the Southern Power Company at Tallulah Falls, Ga.

In Georgia the connection extends through Floyd County only. With the gap closed the extent of the entire interconnection will be about 900 (1,450 km.) miles. The voltage is 110,000, and the capacity of the line is 22,000 kva. The cost of this project is estimated at about $450,000.

Alabama Power Offers $1,000,000 Preferred Stock Locally

TO OBTAIN funds for development work and extension the Alabama Power Company is offering to the public in the territory it serves $1,000,000 of 7 per cent cumulative preferred stock on the installment plan. Any number of shares may be purchased on a cash basis at 93 and accrued dividend, but on the partial-payment plan the number of shares is limited to twenty-five. An initial payment of $10 per share is required and $5 monthly per share.

The Alabama Power Company either directly or indirectly serves a population estimated at more than 550,000 people and supplies electric service in forty cities.

Springfield, Ill., Renews Negotiations to Purchase Utility Properties

NEGOTIATIONS between the city of Springfield, Ill., and the Springfield Gas & Electric Company for the purchase of the company's electric light and power and heating properties by the city have recently been renewed because of the application of the company for a new heating and electric franchise. It is agreeable to the company to include in the new franchise a provision allowing the city to purchase the property at a fair value to be determined by arbitration after a physical appraisal has been made, provided that the city is able to make payment either in cash or in negotiable securities acceptable to the financial institutions of the city. No satisfactory plan of raising the money has yet been made, although city officials have proposed foregoing the issue of $400,000 in bonds voted for extensions to the municipal plant and resubmitting to the voters a proposal for a larger bond issue.

Revised Edition of Safety Code Expected Late in Summer

THE text of the new edition of the National Electrical Safety Code is now almost completed. Lists of proposed changes in the various parts of the code have been circulated for criticism (abstracted in the ELECTRICAL WORLD, page 387, Feb. 14; page 1280, May 29, and page 1387, June 12). Comments upon these have now been received, and the Bureau of Standards is about ready to go to press with the revised edition. Points upon which disagreement exists, it was stated at the bureau, have been resolved almost entirely with respect to the rules governing power stations and those governing utilization apparatus and the grounding of circuits and equipment. The rules dealing with overhead-line construction, it was said, have always been the most difficult to handle on account of the widely differing opinions regarding such construction on the part of the different utilities. It has not been possible to obtain complete agreement on this part of the rules and, it was pointed out, future revisions in this part of the code will no doubt be more intensive than in the other parts. They will involve the collection of more complete data and probably the carrying out of experiments to determine appropriate strength requirements.

It is expected that copies of the new edition of the National Electrical Safety Code will be available late in the summer. It will be printed in pocket-book size, and the discussion of the rules will be entirely segregated from the rules themselves, probably being placed under a separate cover. A pictorial edition of the code, in which the meaning of the rules will be shown largely by illustrations, is in contemplation.

Five-Year Business-Engineering Course at Harvard

A NEW five-year course in business engineering is announced at Harvard University through the cooperation of the Harvard Engineering School and the Graduate School of Business Administration. Hitherto it has been possible at American universities to secure instruction in business or in engineering, but it is stated at Harvard that no combination of the two has been effected which has not involved a diminution in the quality of the egineering training given. The plan, which will be launched at the fall term, is to have three five-year programs, administered by the Engineering School, which will include all the engineering training in the four-year courses in mechanical, electrical and civil engineering and also an adequate training in business administration. Simultaneous instruction in engineering and business will be given during the fourth and fifth years.

Three-fourths of Pacific Gas & Electric's Stockholders Live in California

ACCORDING to the report of the Pacific Gas & Electric Company for the year 1919, which has recently been issued, 6,694 of its 8,813 stockholders, or 76 per cent, were residents of California. This gives the company high rank as an exponent of local ownership of utility securities. Another striking fact found in the report is that, though oil has increased in price 128.6 per cent, labor 45.6 per cent and material and supplies 76.6 per cent in the last six years, these three items constituting 83 per cent of operating and maintenance expenses, the price of electrical energy in the same period has risen only 13.4 per cent and that of gas 10.7 per cent.

The gross operating revenue for 1919 was $25,938,372, an increase of $3,342,856 over 1918; net earnings were $8,180,245, an increase of $324,058, and after paying interest and dividends and setting apart $1,000,000 as additional reserve for depreciation there was a net balance of $103,297, a decrease of $1,477,543 as compared with 1918, when no dividend on common stock was paid.

Industry	Power Sales 1919	Power Sales 1914	Increase, per Cent
Agriculture	$1,094,092	$350,551	212.1
Mining	949,678	591,314	60.6
Transportation	1,021,145	756,343	35.0
Manufacturing	2,682,785	1,553,640	72.7
Commercial and miscellaneous power	1,181,488	487,714	142.3
	$6,929,188	$3,739,562	85.3

The total number of electrical customers was 235,719, a gain in the year of 26,307, and total electric sales were $14,474,884, an increase of $2,090,385. Production reached 994,557,418 kw.-hr., of which 522,234,204 kw.-hr. was hydro-electric, 330,914,990 kw.-hr. steam and the rest purchased, the percentage of increase in total production over 1918 being 7.87.

The intimate relation of the company to the economic life of the large territory served by it will be understood from the accompanying table showing the growth of electric power sales in five years.

Tenney Convention at Boston Notable Success

WITH more than 250 in attendance, the executives and leading employees of Charles H. Tenney & Company, Boston, and of the companies managed by that organization held a highly successful convention at the Engineers' Club on June 24-25. The program included accounting, new business, operating and general sessions, and the following program was carried out: Opening and closing addresses, A. B. Tenney; "Service Sidelights in Customers' Accounting," A. Nelson Lattie; "Keeping the Coal Records Right," G. E. Teel; "The Historical Value of a Good Record of Plant Investment," Kenneth H. Goss; "Checking Up the Appliance Business," L. A. Galbraith; "Advanced Ideas in Customers' Accounting," Harry B. Chase; "The Future of the Gas Business," F. S. Clifford; "Ways of Increasing Electric Revenues," V. M. F. Tallman; "Present-Day Opportunities for Industrial Gas Installations," L. B. Crossman; "Selling Campaigns—Why They Pay," Cyrus Barnes; "The Appliance Department as an Asset in Gaining the Good Will of the Public," H. J. Walton; "Our Fight Against Rising Costs," A. S. Hall; "Present-Day Purchasing Problems," G. A. Rust; "Emergency Operation When Short of Gas-Making Materials," C. E. Paige; "A Consistent Engineering Program as a Factor in Building for the Future," C. R. Hayes. On June 26 an outing was held at Idlewild Grove, Wenham, Mass.

Electrical Credit Men Discuss Cost-Accounting System

THE urgent necessity of contractor-dealers adopting the standard cost-accounting system of the association was the keynote of the twenty-first annual convention of the National Electrical Credit Association, held in New York City on June 17 and 18. About 300 of these companies have already installed this system, but the aim of the credit men is to bring about its widespread operation for the purpose of checking overbuying and preventing dealers from stocking up on merchandise which has little turnover.

After the meeting was opened by President Benjamin P. George, J. H. Pardee, president of the American Electric Railway Association, in reviewing the "Trend of the Times," laid stress on the essential character of the electric railways and their present deplorable condition, giving the restoration of credit as the major task for those who would rehabilitate the industry. Closer co-operation with the contractor-dealer in a business service way and the gaining of the salesman's viewpoint were urged by W. E. Rice of the Western Electric Company, New York City, in his talk on "Constructive Credit Service."

The feature of the second day's program was an address by W. Y. Conrad, vice-president of the Liberty National Bank, New York City. Mr. Conrad analyzed the financial situation and discussed credit from the viewpoint of the banker. George J. Murphy of Boston and W. H. Morton of New York brought out the essential features of the standard cost accounting system.

The president expressed very strongly the appreciation on the part of the association of the entertainment committee's efforts in filling the time between meetings with golf, motor and boat trips, a shore dinner and a theater party.

Election of officers for the coming year was announced as follows: President, Charles R. Oliver, Wetmore-Savage Company, Boston; vice-president, Robert Edwards, Jr., Edwards & Company, New York; secretary-treasurer, Frederic P. Vose, Chicago; assistant secretary-treasurer, Walter S. Vose, Chicago.

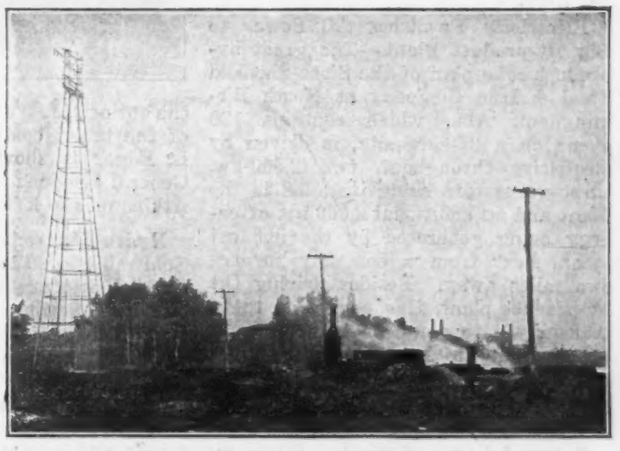
Closer Co-operation Between Electrical Schools and Industry Needed

THE close of the university year finds the schools of electrical engineering unable to meet the demands made upon them for technical graduates. This is the report of the committee on electrical engineering of the Society for the Promotion of Engineering Education, which met at Ann Arbor, Mich., on June 29 to July 2.

The probable causes suggested are the necessarily poor preparation in lower college classes and secondary schools during the war, inadequate recognition of the value of the trained engineer as compared with the salesman and laborer, failure to employ sufficient technical graduates in less prosperous years adequately to man engineering staffs, difficulty of eliminating students not fitted for successful engineering work in entrance examinations and during the course, and lack of proper adaptation of courses to the work engineers are called upon to perform—particularly as sales engineers and engineering executives. Co-operation by the society with large corporations to obtain proper recognition of the value of trained engineers and the employment of adequate technical staffs is suggested, while the technical schools must take measures for the elimination of unsuitable students and the adaptation of their courses to the demands which are made by industry upon graduates.

Increased co-operation between the schools and industry to the end that school work and practical experience may combine to produce graduates better fitted to the needs of industry is suggested.

Longest and Highest Span in New England



THE LINE from Hartford, Conn., crossing over the Connecticut River en route to Manchester, Conn., is the latest high-voltage line and has the longest and highest span erected in New England. The line is designed for 66 kv. The towers are each 235 ft. high, erected on concrete piers 17 ft. square. The span is 1,645 ft. There are two three-phase circuits with steel-reinforced No. 4/0 aluminum cable.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Industrial Lighting Code for Utah.—Utah is drafting an industrial lighting code that will in all probability become a law at the next session of the Legislature. This code is to specify only such systems and intensities of lighting as are essential to the safety of workers.

Rates Advance in Spokane.—Spokane, Wash., is to raise the rates on light and power supplied to commercial users starting July 15. The amount of the increase will be 50 per cent, and it will apply to mercantile establishments, offices, public buildings and all commercial accounts.

Richmond (Ind.) Municipal Plant Asks Increased Rates.—Asserting that the city will soon face a heavy deficit in the returns from its electrical plant unless rates are increased, the Board of Works of Richmond, Ind., has applied to the Indiana Public Service Commission for permission to increase charges to all classes of consumers. Under former conditions the plant earned a profit.

Prohibition and Lighting Bills.—Prohibition enforcement agents in New York City and elsewhere are examining the bills for electricity and gas of places formerly saloons and now supposed to be dispensing non-intoxicating beverages only. The theory is that a large bill shows late hours and that late hours are inconsistent with a thirst-quenching business run on strictly legal lines.

Electricity Furnishes All Power to Big By-product Plant.—The great by-product coke plan of the Sloss-Sheffield Steel & Iron Company at North Birmingham, Ala., which contains 120 ovens on a 25-acre site, is driven by electricity throughout, two 2,000-kw. turbo-generators being installed in the plant and an additional 2,000 hp. of energy being generated by the exhaust steam heat from a company furnace two miles away. Besides driving the by-product plant, this energy is to be transmitted to four blast furnaces at Birmingham, to coal and iron mines many miles distant, to rock quarries and other industries of the company.

Wireless Telephony Grows in Favor.—Successful tests of wireless telephony between fire department headquarters and the scene of a fire have been made in London, and as a possible result wireless telephones may come to be an adjunct to firehouses everywhere. In South Africa, where the chief industry is farming, installations permitting communication between farmers and their foremen and neighbors, as well as with distant towns, are contemplated. In the United States Forest Service the radio instruments have proved their value, and, being less liable to flames, they have in some cases been found superior to line telephones. For instance, as against the destruction by fire of 90 miles of telephone line recently, causing a discontinuance of service for more than a week, the *Wireless World* tells of a case where wireless apparatus was floated on a log raft in a forest lake while the fire swept by and communication was afterward re-established in less than one hour.

Boston Edison Company Honors Its Service Men.—The bronze tablet here shown has been erected by the Edison Electric Illuminating Company of Boston in honor of its 444 employees who served in the war, eleven of whom gave their lives for the nation. The tablet was unveiled at the Edison Service Buildings on the annual field day, June 26, when 10,000 persons took part in

the outing. J. W. Cowles was chairman of the tablet committee. President C. L. Edgar is shown on the right and General Superintendent William H. Atkins on the left of the memorial.

Hydro-Electricity in Dutch Indies.—Gold mines at Tambang Sawah, in the Dutch Indies, are now being served with electricity from a government-built central station at the Tes Lake equipped with water turbines from Switzerland and generators from America. The energy is transmitted over a 20-mile high-tension line. Other water-power and steam stations are being built at Dago, Tjihapit, Tjibadak, Dajeah Kolot and other places equally unknown to the Western world, the intention being the electrification of the railways centering at Batavia, as well as the rendering of lighting, power and industrial service. These ambitious plans, however, will take several years.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Association of Engineers.—Buffalo has been selected as the place for holding the next annual convention of the A. A. E. on May 10, 1921.

Telephone Pioneers of America.—This society will hold its seventh annual meeting at Montreal, Canada, on Sept. 10 and 11, with headquarters at the Windsor Hotel.

American Electrochemical Society.—The next meeting of this society will be held at Cleveland, Ohio. The date is not yet determined, but it will probably be Sept. 30 to Oct. 2.

International Association of Municipal Electricians.—The twenty-fifth annual convention of this association will be held at New Orleans on Oct. 19 to 22. Clarence R. George of Houston, Tex., is the secretary.

Western Association of Electrical Inspectors.—This association has decided to hold its next convention at Detroit, Mich., on Jan. 25, 26 and 27, 1921. W. S. Boyd, 175 West Jackson Boulevard, Chicago, is secretary of the association.

Annual Meeting of A. S. C. E.—The yearly convention of the American Society of Civil Engineers, which was to have been held at Houston, Tex., in October, has been set forward and will be held in Portland, Ore., on Aug. 10-12.

A. I. E. E., Schenectady Section.—These officers have been elected, the vice-chairmen to hold office for two years beginning Aug. 1 and the other officers for one year: Chairman, H. R. Summerhayes; vice-chairmen, A. G. Darling, H. H. Dewey and R. C. Muir; treasurer, F. L. Kemp; secretary, H. Goodwin, Jr.

N. E. L. A., Michigan Section.—At the annual convention of this section, which, as already announced, will be held at Ottawa Beach, Mich., on Aug. 24, 25 and 26, it is expected that consolidation with the Great Lakes Geographic Division of the parent body will be accomplished. H. Silvester is the secretary of the Michigan Section.

Indiana Electric Light Association.—The dates set for the 1920 convention of the Indiana Electric Light Association are Sept. 15, 16 and 17 and the place is French Lick Hotel, French Lick, Ind. Arrangements for the convention are being made by Thomas Donahue, manager of the Northern Indiana Gas & Electric Company, Lafayette, Ind., who is the secretary-treasurer of the organization.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Indiana Law on Service Extensions.—It has been held by the Indiana Public Service Commission, in a recent decision, that an application for an order requiring an electric utility to extend its service to prospective consumers within an incorporated town must be dismissed since under the state law city and town authorities and not the Public Service Commission have jurisdiction over extensions of all utilities operating within corporate limits.

Commission Refuses to Question Books Kept in Accordance with Its Rules.—A suggestion in a rate proceeding that a large utility company was keeping a double set of books for the purpose of deceiving the commission was declared by the Washington Public Service Commission to be entitled to no consideration, inasmuch as the books were kept according to the commission's official classification of accounts and were subject to unexpected calls by the commission's accountants for personal investigation.

Responsibility of Electric Company for Interruptions to Service.—In ordering a careful record of interruptions to the electric service furnished the city of Bremerton by the North Pacific Public Service Company to be kept, the Washington Public Service Commission expressed the opinion that when the power upon which a city relies is transmitted over a line 92 miles in length passing through a heavily timbered belt of country interruptions will result regardless of reasonable care on the part of the utility. Before ordering the installation of larger steam auxiliary plants the commission decided to await the result of efforts made by the utility to remove the causes for interruption of service.

Undesirability of Different Rates for Competing Companies in Same Territory.—Granting the petition of the Southern Sierras Power Company for permission to charge the same rates in San Bernardino as were charged by its competitor, the Southern California Edison Company, under a ruling authorizing a temporary surcharge of 27 per cent on all its electric rates, the California Railroad Commission observed: "For very substantial reasons the rates of these two companies where they are in competition should remain the same. A marked difference in rates, such as would result if this application were not granted, would cause a transfer of business from the high-rate to the low-rate company, thus imposing a burden resulting in a denial or breakdown of service. From every standpoint it is better that the rates of these two companies be kept on a parity, at least until final rate schedules are established."

Abnormal Transformer Losses as a Factor in Rate Making.—In an action for increased rates brought by the Amity Light & Power Company before the Public Service Commission of Oregon it developed that because of the sparsely settled communities served by the company and the small total load the line and transformer losses are extremely heavy, ranging from 55 to 60 per cent of the total energy purchased, or more than twice the losses on the average electric system. While granting a substantial increase in rates, the commission strongly recommended that the utility investigate the feasibility of limiting the day service to about two days per week and the night service from about dusk until midnight in order to minimize the heavy losses attending twenty-four-hour service and to make lower rates profitable.

Principles Governing Massachusetts Department in Fixing Rates for Electricity.—The selectmen of the town of Orange having applied to the Massachusetts Department of Public Utilities to order a reduction in the rates charged for electrical energy by the Athol Gas & Electric Company, the department, ordering a maximum rate of 14 cents a kilowatt-hour pending consideration of the company's revised schedules, laid down a number of principles governing its action, among them the following: (1) A fear that depreciation allowances will be dissipated in dividends is not a ground for denying to the company earnings adequate for its needs; (2) rates made to large industries must take into consideration shutdowns and periods of depression and cannot be based solely on the experience of prosperous years; (3) special rate contracts with large consumers cannot be considered objectionable where there is no evidence that such contracts throw a burden upon the other consumers; (4) while there may be excuse for making new rates and special contracts to obtain business beyond the scope of existing rates, there can be no justification for giving any advantage to one customer not offered to all under like conditions; (5) it is desirable and even necessary to take into account not only the load factor but the power factor of large customers, penalizing failure to maintain a reasonably good power factor and offering inducement for its improvement; (6) failure to raise rates to the street railway at the time rates to all other customers were raised cannot be justified upon the theory that the company purchased power primarily for the street railway company and that the cost of purchased power had not been increased, nor upon the theory that as the street railway company was finding it difficult to earn revenue enough to keep its cars in operation such discrimination operated to the benefit of public transportation.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Electric Burglar-Alarm Company a Public Utility.—The New York Court of Appeals finds that an electric burglar-alarm company incorporated under the telegraph act of 1848, with the right to use public streets for its lines or condemn private property therefor, is a public service corporation and subject to regulation as such. (127 N. E. 315.)

Damages from Flooding Land.—In an action against the Rutland Railway, Light & Power Company for damage caused by the flooding of plaintiff's land by obstruction in stream, where the evidence showed that at first only a small portion of plaintiff's land was flooded, but that the quantity increased from year to year, an easement by prescription could only affect the damages as to the land which had been flooded for a term of years and not as to land flooded within recent years, the Supreme Court of Vermont has declared. The owner of an easement cannot increase the burden upon the servient estates nor impose a new burden thereon. (110 A. 4.)

Title to Water Rights at Dolgeville, N. Y.—In a suit brought by S. R. Inghain against the Herkimer Light & Power Company, the Supreme Court of New York, Appellate Division, has cund that where an owner of riparian lands, having first leased and afterward contracted to sell these lands to a hydro-electric company of which he was himself the virtual owner, subsequently made an assignment and some of the property concerned was sold by the assignee, the purchaser thereof had no right to any portion of the rent named in the original lease, that lease having, in the absence of any reservation, been superseded by the contract of sale. (181 N. Y. S. 863.)

Power of Utility to Increase Rates Without Sanction of Commission.—Declaring that the Public Service Commission of the state is a body of limited powers and may do only that which the statute specifically prescribes it may do, the Supreme Court of New York has decided that a gas company can make effective an increase in rates thirty days after filing a new schedule with the commission though the increase has not been sanctioned by the commission and a proceeding involving the issue is pending. The commission is required to hear evidence to determine the reasonableness of rates before entering an order holding them unreasonable, and an order entered before hearing does not support summary proceedings. (182 N. Y. S. 55.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Richard C. Carter, for many years connected with the Central Maine Power Company, has been appointed superintendent of the Belfast district, relieving Merton L. Taylor, who has been acting superintendent since the transfer of H. P. Blodgett to the Rockland district as superintendent of the company there.

Prof. Carl E. Magnusson, who was elected a vice-president of the American Institute of Electrical Engineers for the coming year, is professor of electrical engineering and acting dean of the College of Engineering at the University of Washington. Professor Magnusson received his degree of doctor of philosophy from the University of Wisconsin in 1900 and for several years was professor of physics at the New Mexico School of Mines and the University of New Mexico. Since 1904 he has been at the University of Washington and since 1906 has been head of the department of electrical engineering at the university. He spent a year at the General Electric Company's plant at Schenectady studying under Charles P. Steinmetz.

C. E. MAGNUSSON

E. S. Purington has resigned his position as associate physicist, Bureau of Standards, to accept a position as a research engineer with the Hammond Radio Research Laboratory at Gloucester, Mass. Mr. Purington has for the last year been engaged in research work in connection with the applications of electron tubes in power equipment, especially in radio-telephony.

Edwin B. Katte, chief engineer of electric traction of the New York Central Railroad, has been chosen chairman of the newly organized railroad section of the American Society of Mechanical Engineers.

Frederick A. Anderson has recently been promoted from electrical inspecto of the Southern Pacific district of the United States Shipping Board to senior electrical engineer of the same district with headquarters at San Francisco, Cal.

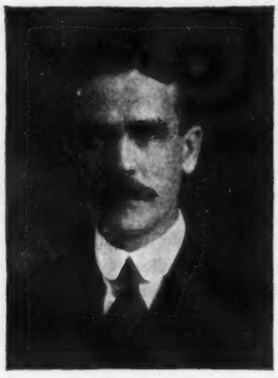
C. S. Kennedy has resigned as general superintendent of the Indiana & Michigan Electric Company, South Bend, Ind., effective July 1, to become general manager of the Iowa Southern Utilities Company with headquarters at Centerville, Iowa. Mr. Kennedy has been connected with the Indiana & Michigan Electric Company for the past twelve years.

C. S. MacCalla has resigned as manager of the Rochester works of the General Electric Company to become vice-president of the Virginian Power Company, Charleston, W. Va. Mr. MacCalla was made manager at Rochester only a short time ago. He was vice-president and general manager of the Washington Water Power Company from 1903 to 1918, having previously been associated with the foreign department of the General Electric Company for two years at Sydney, Australia. For four years he was with the Brooklyn Edison Company.

H. A. Kidder, electrical superintendent in the motive power department of the Interborough Rapid Transit Company and the New York Railways, New York, has been appointed assistant superintendent of motive power of these companies pending final severance of the relations of W. S. Finlay, Jr., with those organizations in the near future, at which time Mr. Kidder will become superintendent of motive power. Mr. Kidder began his career with the above companies as assistant electrical superintendent in 1906, prior to which time he was connected with the General Electric Company in its railway engineering department, and in the following year he became electrical superintendent in charge of all electrical operating equipment.

H. A. KIDDER

Prof. Hector James Hughes has been appointed dean of the Harvard Engineering School, succeeding Dean Comfort A. Adams. Professor Hughes was born at Centralia, Pa., in 1871, was graduated from Harvard College in 1894 and received the degree of S. B. from the Lawrence Scientific School in 1899, in the course in civil engineering. Dean Hughes has had a wide experience in municipal, railroad, drainage, bridge and hydraulic engineering. He has been engaged in consulting engineering since 1905, including industrial and power-plant construction. He became instructor in civil engineering at Harvard in 1902 and in 1903 was made assistant professor and later full professor. Dean Hughes is a member of many engineering societies and is a partner in the firm of Burke & Hughes, Cambridge.



H. J. HUGHES

Stacey Hamilton, who for a number of years has been devoting his time to light and power problems and general statistical and engineering work for the Portland (Ore.) Railway, Light & Power Company, has been appointed organization inspector of that company. His new duties will include the making of special inspections, investigations and reports pertaining to the various departments and operating details of the company and he will report directly to the president of the company, F. T. Griffith.

Obituary

Brig.-Gen. William L. Marshall, United States Army, who from 1908 to 1910, when he retired, was chief of engineers, died July 2 after a short illness. General Marshall was the inventor of various lock gates, valves and other hydraulic equipment.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

United States District Court Upholds Coolidge Lamp Patent Suit

THE Coolidge wrought-tungsten patent, under litigation for nearly five years, has been declared valid in all of its claims, and to have been infringed, in a decision handed down on June 29 by Hugh M. Morris, judge of the United States District Court, in the matter of the suit brought by the General Electric Company against the Independent Lamp & Wire Company, Inc. Considerable importance is attached to the outcome of the case because of its fundamental application to the manufacture of incandescent lamps.

In the opinion of the court, the solution of the tungsten problem involved invention, and in that invention the specific problem was to make tungsten ductile and eliminate brittleness. It has been held that Dr. Coolidge accomplished this in the production of his wrought tungsten from the natural tungsten metal. The main product and process claims are held valid in the court's opinion.

Dr. Liebmann, of the Independent Lamp & Wire Company, when questioned by a representative of the ELECTRICAL WORLD, preferred to make no statement at the present time as to the probable course of that company regarding an appeal of the case.

Heavy Buying of Heaters in Winter Just Passed

THAT the winter of 1919-20 would be a good season for the sale of electric heaters was well anticipated by jobbers in the volume of orders placed before last summer closed. These distributers bought in the early season more socket heaters than ever before, and shipments were as a whole in such condition that stocks were sufficient to care for the demand when the winter started in cold and early. At the same time, scattered jobbers had rather large stocks carried over from a previous warm winter and one in which some late deliveries were made.

The past season, however, surpassed all previous ones in heater sales. It was long and rather severe, and after the first of the year shipments were badly delayed. In the metropolitan district the severity of the weather was attested in the high volume of sales, and right up to the month of May jobbers reported fair movement of stock because of disagreeably cool weather.

Very few jobbers in this territory have any great number of heaters to hold over. Where this is the case it is because shipments made from the factory in the early months of the year were received too late to be of much use in that season. But some small delayed receipts were quickly disposed of among the trade. In several instances jobbers report no stocks at all and, as a whole, stocks at present are low. There are probably 5,000 heaters in the metropolitan district in jobbers' hands, more than half of which were received too late for cold weather. From reports to date from about a dozen representative jobbers, an estimate of sales has been made of a minimum of 40,000 heaters in just that small area. Consequently the hold-over is less than 10 per cent if shipments delayed by bad transportation are not considered.

Early reports of anticipated future business show that in general the pre-season orders are not going to be quite so large as last year. On the other hand, some jobbers expect to order from a number equal to that of last season to half as much again. At the same time, it would appear that the coming season should be at least as good as the last season in view of the progress in building that has been made during the year and the threatened shortage of coal next winter through inadequate transportation.

New England Sales Heavy

Notwithstanding delayed deliveries, New England jobbers report in the main a better season recently closed in socket radiators than last year. As usual, individual sales vary widely, but several of the larger houses disposed of 25 to 30 per cent more outfits than in the winter of 1918-19. Estimates vary considerably as to the total market per annum for radiators in New England, but from 25,000 to 35,000 minimum were disposed of last winter and spring, and the market is rapidly growing with the rising cost of anthracite coal and the intensive publicity which the trade is applying to these devices.

Seventeen leading jobbers had about 1,800 radiators in stock on July 1, the individual inventories showing totals from 500 down to bare shelves. Among the smaller houses, stocks are very low and are likely to be cleaned out by the summer demand, which is of course small but selective, with the vacation camp and cottage a valued buyer. The outlook is excellent for fall and winter business, partly because the price of domestic heater coal threatens to rise further before snow flies and also because the consumer of central-station service is rapidly becoming acquainted with the real economy of short-time intensive and localized heating compared with the expense of "starting up" the furnace with its large bulk of fuel for such work.

A few jobbers are carrying over small stocks from late spring because deliveries were too slow to permit disposal of pre-season orders before warm weather. Thirteen jobbers report that they will purchase probably 3,700 radiators for fall trade this year, and in addition about 2,400 are on order from the manufacturers. Prices have not appeared to affect sales very much, in view of the acute coal situation.

Large Stocks in the South

Despite the phenomenal sale of air heaters last season large stocks of this specialty were carried over by local jobbers, owing in a measure to receipts of shipments late in the season. Jobbers indicate a tendency to go slow on the placing of orders for fall delivery, as they seem to feel that the peak of popularity of this device has been passed and that air heaters will not be in so heavy a demand for the coming winter as they were last winter.

West Coast Expects Good Increase

The bulk of the electric radiators marketed along the Pacific Coast are manufactured in California, thus securing prompt service and preventing to a certain extent any great accumulation of stocks at the end of the season. The unusually early, mild and dry spring, however, spoiled the usual demands holding from January to March, and most of the dealers carried over pretty fair stocks through the season. Another fact to be remarked is the greater variety of heater stocks carried, nearly all dealers carrying at least two different makes, often parallel types. An increasing demand for fireplace types is also noticeable.

Nearly all radiators for the 1920-21 season have already been ordered, there having been keen competition among

jobbers for this business, which has been solicited in advance. In general a 50 per cent advance over the previous season's business is anticipated. During 1919 business, by the way, measured a 41 per cent advance over the 1918 business.

Decision in Lumber Case Sounds Warning to Associations

TOO much care cannot be exercised by associations of men in the electrical industry interested in one activity or another in always keeping before their members the legal bounds which must not be overstepped through enthusiasm or lack of knowledge of the conditions. A case in point has just come to notice where such an association in the industry has ceased to transmit certain information among its members, not because that information contained any reference to prices in any shape or manner—it did not—nor because it believed it was running contrary to law, but merely in order to eliminate any possibility of the searching glance of Federal authorities which might bring it into notice and provide the slightest murmur of a question. It was a matter of playing on the safe side to avoid suspicion.

It is interesting to recall in this connection the result of the suit instituted by the United States of America against the American Column & Lumber Company and 332 other defendants, heard last March. It was the Government's suit under the Sherman act against the so-called "open competition plan" of the hardwood lumber manufacturers who are members of the American Hardwood Manufacturers' Association. The Government showed in this case that the members continuously exchanged with one another, through a common secretary, reports showing their respective rates of production and stocks on hand and also showing the prices which each member had received on actual sales of lumber. Furthermore, it was established that the tendency of such an interchange of information among the defendants was to increase their prices, as the Government had charged.

John E. McCall, United States District Judge, enjoined the defendants from continuing to exchange the reports in question in the application for preliminary injunction. From the evidence on file, the common note running through it all was that of increase of prices, and the conclusion could not be escaped that the purpose and intention of the plan was to suppress competition among its members and create a condition in that industry wherein production was to be kept low enough to maintain prices on an ascending scale, but not low enough, because of price heights, to induce resort to substitutes.

Armored-Conductor Market Expected to Continue Strong

AS FAR as can be learned there is no evidence of any weakening in the market for flexible armored conductor. Several jobbers in the East have recently let fall a remark that they thought the market on this material was beginning to show a little falling off. It is probably true that the trade is not ordering so far ahead as it has done in the past because of the general feeling of aversion to such long futures. Conductor has been coming into the market in better volume of late because more effort is being placed on obtaining raw materials and getting the finished product through.

Jobbers have been applying almost every bit of armored conductor which has come to them of late on the pile of back orders which are still unfilled. The common price in this case has been in the nature of $110 to $125 per 1,000 ft. for two-wire. Little difference has been made between single-strip and double-strip because of the shortage of both. The material which has been sold on new orders has for the most part been on accommodation orders and on rush work, and has been sold to as high as $150.

Manufacturers of rubber-covered wire find that market keeping up in good shape but do not report any great increases in business in No. 14 wire. The market for this size has a bearing on the market for flexible armored conductor. With a good supply of knobs, tubes, cleats and loom, the demand for No. 14 rubber-covered wire is in general greater than when those wiring materials are in poor supply. This open wiring is the most common kind used in the less congested districts of the country, but when the supply of porcelain is low flexible armored conductor has a heavier call as a substitute. In addition, it has its own field to supply. Porcelain stocks are low now and there is no evidence of their bettering in a long time. So the armored-conductor demand can be expected to hold up to a certain extent because of this one fact as long as so much building and repair work is necessary.

Factory shipments of porcelain, loom, No. 14 rubber-covered wire and armored conductor are much behind, and every bit of this material that can be produced is needed to satisfy the building demand. Consequently it hardly seems that there is any foundation for even the faintest consideration of a weakening in the armored-conductor market for some time to come. Building activities are fluctuating in various localities because of high prices, lack of material, etc., but at the same time the need still exists.

Stranded-Steel-Wire Market Steady Under Short Supply

ALTHOUGH demand for stranded steel wire is not extra heavy, manufacturers are having considerable difficulty in meeting orders. The volume of buying has increased slightly over a year ago, but is still subnormal if anything. Little new construction work is being undertaken, repairs and replacements accounting for most of the orders. Where formerly the electric railways would stock ahead on suspension and guy wires, money tightness is now causing them to cut expenditures to the bone; consequently stranded wire is ordered only as absolutely needed.

In spite of this circumstance production is generally inadequate to meet demands, one of the largest wire producers reporting operation at only about 65 per cent of capacity owing to raw material and transportation difficulties. Another manufacturer has been hindered by labor troubles, the mills of this company operating only seven months last year because of strikes. Zinc is reported hard to obtain; hence the process of galvanizing stranded wire is one more factor delaying some producers, although other mills which own their own zinc and coal mines are free from this trouble.

As a result of these conditions orders are running further and further behind, with deliveries ranging from ten weeks to five months. Stocks in this field seem to have gone out of existence. Transportation difficulties continue to tie up shipments at the mills; in fact, with the recent coal priorities order in force, manufacturers report no relief in that quarter.

The encouraging features of the situation seem to be the entire absence of order cancellations and the continued steadiness of the market, prices having remained firm during the past year, although the tendency would seem to be up at the present time.

Manufacturers Assist Yardmen in Freight Movement

RATHER than face curtailed production because of inability to obtain raw materials or to ship finished products, manufacturers of the country are beginning to realize that the freight congestion in the terminals must be relieved. In order to help out there is a growing movement among the manufacturers to supply switchmen, yardmen, etc., to the railroads from their own organizations. As each manufacturer has only to furnish a few men, the strain on the organization is not severe, and yet at the same time the help rendered the railroads in the move-

ment of cars at the terminals is extremely valuable. Boiler-room equipment producers and those of certain types of bearings have been active in this connection, it is learned.

One of the practices which have been rather harmful to the movement of terminal freight as a whole is that of giving gratuities to the yardmen. No doubt it is worth $50 or $100 to a company to have a car moved, but at the same time the effect on the general movement is to slow it down. In the opinion of some industrial men there have been evidences of collusion among yardmen due to these gratuities from the receiver or the sender and intended to extort further bonuses.

Stocks of Carbon Brushes in Good Supply

MANUFACTURERS of carbon brushes report the situation as being very favorable. Production has increased generally, and though only nominal stocks of finished brushes are on hand, stocks of unfinished material are in good shape to handle any orders likely to come in.

Deliveries are being made more promptly than heretofore, averaging from ten days to three weeks. Shipments of the standard railway type of carbon brushes are a little slower because these orders are being placed in larger quantities. One local agent who recently returned from a tour of the country states that electric railways are quite heavily stocked up on brushes.

Demand is good, much of the ordering being for replacements as well as for the construction of new motors. The market has held steady for some months, and manufacturers say no fluctuation is in sight at present. Labor, however, is the chief item in the cost of carbon brushes, and because the labor market has been unsteady indications are that any price change would be upward.

Stocks of foreign brushes are in sufficient condition in this country to supply normal orders, while new material can be quoted on six weeks' delivery. French production is about 50 per cent above pre-war volume.

Metal Market Situation

MORE activity is being shown in the copper market than for some few weeks past. The outside market has raised its prices to nearer 18.50 and 18.75 cents from the 18.25 cents for which it could have been bought a week ago, and some sales have been made. Producers, who have been quoting 19 cents for several weeks and who have held that figure despite the small amount of metal which they have sold, are finding the beginnings of a returning market. Sales to regular domestic consumers have been recorded at that figure for delivery over the present quarter. Where consumers have expressed a desire to cover at this figure for fourth quarter the producers do not seem to be especially anxious to book for so far ahead at that figure. A slightly better condition of transportation is reported this week.

NEW YORK METAL MARKET PRICES

	June 29	July 6
Copper	£ s d	£ s d
London, standard spot	85 15 0	87 0 0
	Cents per Pound	Cents per Pound
Prime Lake	18.50	18.75
Electrolytic	19.00	19.00
Casting	17.62½	18.00
Wire base	22.50–23.00	22.50–23.00
Lead, trust price	8.00	8.00
Antimony	7.50	7.50
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	12.50
Zinc, spot	7.95	8.15
Tin	49.00	48.25
Aluminum, 98 to 99 per cent	33.00	33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	15.00 to 15.50	15.00 to 15.55
Brass, heavy	9.00 to 10.00	9.00 to 10.00
Brass, light	7.00 to 7.25	7.00 to 7.25
Lead, heavy	7.00 to 7.25	7.00 to 7.25
Zinc, old scrap	5.00 to 5.25	5.00 to 5.25

THE WEEK
IN TRADE

NO DECREASE in the volume of sales for all classes of electrical material is noted in the East and South, but an appreciable slackening of demand is reported from the Middle Western and Northeastern sections as the natural outcome of summer trade dullness.

Transportation conditions show some improvement, especially in Chicago and Boston territory, and an increasing resort to shipping goods by express is noted. Collections on the West coast are in better shape than in the East, where, in the New England and Southern states particularly, collections of bills are becoming increasingly difficult.

Fan stocks are still generally awaiting prolonged warm weather. Rigid conduit shows a marked shortage throughout the country, but supplies of armored conductor are coming through in slightly better shape except in New York territory. Porcelain is conspicuous by its absence, minor price increases being reported on one or two items. With fair stocks of loom accumulating, jobbers are beginning to catch up on back orders. In general, the market has held steady the past week.

NEW YORK

The volume of sales generally reported by jobbers shows little sign as yet of the expected advent of summer trade dullness. In some quarters the business from contractor-dealers is said to be falling off, but on the whole demand is as stiff as ever.

Incoming shipments are still bad, but in many cases relief is being found by resorting more and more to the express companies. Collections are good considering the general tightness of money.

Building activities and industrial work, as reflected in sales of electrical material, are being well maintained. The city has recently awarded contracts totaling more than $5,000,000 for the construction of new freight sheds on Staten Island.

Lamps.—Demand is holding up well, and shipments are coming through better than previously. Stocks are still spotty though somewhat improved.

Rigid Conduit.—The situation presents almost a famine aspect, with supplies shot to pieces and very irregular shipments in the face of an excellent demand. One jobber just received a quantity ordered last July. Orders are turned down quite regularly, and many jobbers will not quote prices.

Flexible Armored Conductor.—Recent isolated shipments in good quantity caused talk of a break in the market, but these receipts were only a drop in the bucket. No hope of relief is held out, the trade being on an allotment basis. Demand continues very strong, back orders at once absorbing inconsequential shipments. Connectors are reported in fair shape. Prices for No. 14, two-wire, average $115 in 1,000-ft. lots.

Fans.—Demand with some jobbers is strong, while for others it has not yet started strongly. Shipments are fairly good, some distributers now resorting to trucks for supplies. Stocks are spotty, one jobber having to buy several hundred fans from other jobbers as a result of ordering late. Ceiling fans have a rapid turnover this year.

Rubber-Covered Wire.—Stocks vary all the way from "poor" to "good." Some jobbers report normal shipments, but not so with all, as one company has received no supplies for a month. Demand is only fair, the smaller sizes moving fastest. The price for No. 14 ranges from $11.50 to $13.

Porcelain.—Reports on knobs, tubes, cleats, etc., are uniformly the same—strong demand, stocks absolutely de-

pleted, and no supplies coming in. Several manufacturers recently withdrew prices on rosettes, sockets, etc.

Wall Panels.—Demand is strong, with considerable shortage being met, especially in the larger sizes, although here and there jobbers report plentiful stocks. Irregular shipments are applied on back orders. Steel mills are loath to accept new orders for sheets, and the price remains well up.

Tape.—A general scarcity is being relieved by the arrival of back orders with some jobbers, but stocks are generally low and embargoes holding up shipments. Friction tape is in slightly worse shape than rubber. Demand for both kinds is strong. Friction tape in 100-lb. lots averages around 58 cents, and rubber tape 55 cents.

Schedule Material.—Demand is strong and stocks are spotty. Some devices are slow while others are moving easily. One jobber is short on candelabra fittings and receptacles; another has not a single pull or key socket in the house. Waterbury factories are reported closed down.

BOSTON

Orders flowed into jobbers' offices without much diminution the past week. Deliveries are improving somewhat, owing to vigorous efforts by the railroads and consignees to move material. Heavy passenger traffic, however, handicapped freight movement over the Fourth. Collection reports are less favorable and a close watch is still being kept on credits. Small motors are almost unobtainable for the moment. Stocks of schedule material, lamps, rubber-covered wire and flexible armored conductor are sufficient to meet immediate requirements, and some rigid conduit is coming in from time to time. Contractors are very busy and a large amount of rewiring in industrial plants is being handled. Building and engineering contracts in New England to July 1 totaled $179,568,000, against $80,552,000 for the first half of 1919. Increasing activity is evident in steel shipyard work, and considerable buying of supplies from jobbers is under way in prospect in connection with government and merchant ship construction. Labor difficulties still persist in the Naugatuck Valley.

Fans.—Retail stocks are plentiful, owing to poor fan weather. A few fans are still on order for jobbers' stocks. The demand this year is greatest for the oscillating type. Some price-cutting in smaller sizes appears likely.

Washing Machines.—Stocks are irregular, with very active demand. Less trouble regarding wringers is noted, and motors are ordered so far ahead that little is heard about delayed outgoing shipments on this score. A representative make sells for list less 25 per cent off in lots of three.

Fixtures.—Excellent sales are reported. Stocks purchased well ahead are minimizing the effect of labor troubles in the brass industry. Brass canopies are somewhat short, however. Prices are showing signs of weakening a little under close competition.

Wire.—Rubber-covered No. 14 is quoted at $11.50 per 1,000 ft. in 5,000-ft. lots; weatherproof base is 30 cents to 32 cents per pound, with uneven supply, and bare copper wire sells on a 26-cent base. In some jobbing circles higher prices for copper are anticipated by fall. Weatherproof shipments are improving somewhat.

Flexible Armored Conductor.—Good stocks are on hand. No. 14 single-strip is quoted around $112 per 1,000 ft. in 5,000-ft. lots.

Non-Metallic Flexible Conduit.—Fair stocks are reported. The $\frac{3}{8}$-in. size and $\frac{1}{2}$-in. size are selling at $35 and $38.50 per 1,000 ft., in 1,000-ft. lots, respectively.

Flatirons.—Sales are active for both summer and year-round use. A standard make sells for $4.85 in lots of forty-eight and for $5 in lots of twelve. Deliveries are too long to suit many buyers.

Toasters.—Trade is brisk, with stocks running low.

Tubes.—Porcelain tubes, 3-in. size, recently were increased in price from about $10 to $11.35 per 1,000 in barrel lots. This material is hard to get on account of railroad conditions.

Rigid Conduit.—Jobbers are caring for old customers as shipments of past order "come into port." Modest stocks are reported but these are spotty as to sizes.

Friction Tape.—In 100-lb. lots, a quotation of 55 cents per pound was current at the week-end on $\frac{3}{4}$-in. black tape. Fair supplies are now obtainable.

Sockets.—Owing to the scarcity of composition handles, key sockets are not quite so plentiful in some localities, though no serious shortage is reported. These are quoted in case lots at 28 cents, with keyless at 26 and pulls at 50 cents.

CHICAGO

The gradual improvement in freight conditions, coupled with a general decrease in demand for all classes of merchandise, is tending toward more rational conditions in the electrical goods market in this district. An embargo was this week laid on all intercity shipments except perishable ones in the Chicago area, with a view to finally clearing out the accumulation of through-billed cars which are stalled in this territory. Perhaps as a result of this most jobbers report increased receipts during the week and a proportionate relief in famine conditions. Various wires, particularly in larger sizes, lamps and flexible and rigid conduit are reported in better supply.

A general weakening of demand in all lines is felt with the single exception of pole-line equipment. The porcelain, hardware and tool situation is very acute, with no sign of relief. Demand on the part of all public utilities for new and replacement line equipment has been quite light all spring, but the month of June shows an increase, due, probably, to the measure of relief granted certain power and light companies by the various public utility commissions.

Flexible Armored Conductor.—Recent receipts have been in increased volume, the major portion, however, being applied on back orders, leaving stocks badly broken. Jobbers are unable to name delivery dates with accuracy. In coil lots, No. 14 single-strip is quoted at $110 per 1,000 ft.; $10 higher in smaller quantities.

Non-Metallic Flexible Conduit.—The $\frac{3}{8}$-in. size is quoted at $35 per 1,000 ft. in quantity, $55 in short lengths; $\frac{1}{2}$-in. at $37 and $60. Stocks remain in bad shape, but the quantity of goods on back order is decreasing. Jobbers report diminished demand.

Rubber-Covered Wire.—Improvement in stock conditions is noted with shipments arriving with increasing promptness. While nearly all dealers' stocks are broken, all sizes are obtainable in reasonable quantities if sufficient effort is made to locate them.

Rigid Conduit.—Substantial quantities have been received, but the amount required to fill back orders on file is so great as still to cause a marked shortage. With improved freight service no further serious difficulty is anticipated. Three-quarter-inch and half-inch sizes are particularly hard to obtain.

Fans.—As is usual, the 16-in. oscillating fan is in greatest demand, but delayed shipments cause small sizes to be also almost unobtainable. Dealers report that retail demand in all sizes is somewhat below expectation. This is in line with decreased retail sales in all classes of household utilities.

Line Material.—No amelioration of short stock conditions is reported in hardware, insulators or tools, indicating that the shortage is due to manufacturing rather than transportation difficulties. Demand is brisk, with jobbers largely unable either to fill orders or promise delivery. This is a situation that will require much time to straighten out.

Heating Appliances.—Jobbers' receipts are still far behind orders, but retail sales are likewise less than expected. This may be attributed to recent price increases, to frequent substitution required by reason of lack of popular makes, or to general retail conditions. In spite of low stocks; dealers are able to handle all demands that are now pressing.

ATLANTA

The first six months of 1920 have set a new building permit record for the city of Atlanta, the month of June having overtopped permits of any previous month in the city's history by a considerable degree. The grand total of permits for the first six months was $8,812,573, and June contributed $2,324,662 to this total. Despite the large number of buildings under construction, a considerable break in the lumber market is to be noted in the large industrial centers, attributable to the great difficulty in obtaining cars for outgoing material, shipments for the week for 146 mills being 34 per cent below production.

There is a tendency on the part of the general public to offer increasing resistance to exorbitant prices, and this is reflected by a disposition of the wholesalers and retailers to tighten up in the placing of orders. On the whole, however, there is little or no fear expressed regarding the future of business in the territory and the volume of retail trade continues large.

A heavy demand for money is reported throughout the district and this naturally has caused an increase in the interest rate. Collections as a result are tightening up, and jobbers report increasing difficulty in obtaining remittances promptly from their rural trade, especially in the southern districts.

Flashlights.—As a probable result of the national advertising campaign, demand is holding up unusually well. Cases, batteries and lamps are moving well, and stocks, as a rule, are in good condition. Good shipments are reported by all jobbers.

Wire.—One of the largest jobbers reports his stocks of wire, weatherproof excepted, in fair shape, though he has little or no weatherproof on hand. Other jobbers report a shortage of weatherproof and No. 12 rubber-covered. On the whole demand is out-running the supply.

Interphones.—A slackening in the demand of this article is reported, owing to the fact that contracts for apartment-house construction were let early in the spring in anticipation of slow deliveries. As a result jobbers have been able to accumulate fair stocks of this material.

Lamps.—While some difficulty in obtaining sufficient quantities of lamps was reported several weeks ago, one of the largest jobbers reports that stocks are now in such condition as to meet all reasonable demands. All types of lamps are moving satisfactorily, but a particular activity is to be noted in type-C lamps in 100-watt to 200-watt sizes.

Non-Metallic Flexible Conduit.—The shortage existing in the territory will be somewhat relieved by large incoming shipments expected daily. These shipments will be sufficient to fill a large number of outstanding back orders, but will not leave any stocks on hand. Price, ½-in., lots of 250 ft. to 1,000 ft., $5.06 per 100 ft.

Porcelain.—A large shipment of porcelain, consisting of knobs, tubes and cleats in sufficient quantities to take care of back orders, is reported by one of the local jobbers. No stocks will remain after filling back orders, while the demand continues exceedingly strong. Prices, tubes, ⅞ in. by 4 in., standard packages, $1.57 per 100; No. 1 "Nail it" knobs, lots of 500 to 4,000, $4.99 per 100; cleats, lots of 300 to 1,850, two-wire, unglazed, $3.28 per 100.

Heating Devices.—Very poor stocks of heating devices are reported by all jobbers, who are complaining strenuously of their inability to accumulate any stocks for fall trade. The retail trade is being urged to place all orders for holiday material at the earliest possible date in order that dealers may receive their allotment of material.

SEATTLE—PORTLAND

Trade conditions in the Puget Sound district remain in about the same condition as reported for the past few weeks, though, if anything, jobbers' sales are lighter. Retailers, however, say that sales show no fluctuation and that as a whole they have been comparatively satisfactory. The sudden advent of warm weather last week made fans in good demand, although sales were not of enough moment to affect the general volume of sales Irregular and delayed shipments are still a cross to the jobbers. Prices as a whole show no particular change. Collections are fairly good. Logging and lumber production in Oregon and Washington may be seriously interfered with by a shortage of fuel oil. Recently one of the leading oil companies gave notice that the fuel supply is becoming more stringent daily and that orders are anticipated to discontinue deliveries of fuel oil to all not protected by written contracts, and when these contracts expire deliveries are to cease.

The Portland district reports that owing to the Shriners' Convention and the rose festival the business of jobbers, contractors and dealers fell flat during the latter part of June. Retailers state that trade for June was materially below that of May. Collections and the credit situation in Portland territory appear to be about the same as for some time past. No price changes have been recorded. The Enterprise Electric Company at Enterprise, Ore., plans immediate construction of a large hydro-electric plant utilizing the waters of the Wallowa River. The first unit will develop 1,500 hp., and unofficially it is stated that 15,000 hp. will be ultimately developed.

Fixtures.—Further decreases are noted in fixture sales because of the reduction in residence construction. Stocks are fair and shipments are coming through sufficient to care for needs.

Schedule Material.—During the past week sales in this line showed very little activity, especially during the latter part of the week, owing to the exodus from the city for the Fourth of July holiday. Slackness of demand is giving jobbers an opportunity to build up their stocks, which are sadly in need of replenishment.

Porcelain.—The demand for knobs, tubes and cleats is light owing to lack of new construction. Jobbers are replenishing stocks, and prices are unchanged. Deliveries range from four to six months.

Motors.—Anticipated demand from the logging and lumber industry for equipment to be installed during the midsummer shutdown did not materialize to the degree expected.

SAN FRANCISCO

Despite an undercurrent of rather pessimistic feeling, for which there is no actual justification, business continues very good. The electrical contracting business is in the throes of the usual summer let-up, but the number of big jobs under way is gratifying. Credits are being very jealously extended, and banks are lending money sparingly.

Schedule Material—There is a big and constant demand for all kinds of schedule material, and even manufacturers and jobbers who anticipated this demand find that past accumulations of stock are not sufficient in themselves. Deliveries are good, although retarded by the Eastern freight embargoes. These have been minimized by some firms, which have routed their shipments, partly at least, through Canada.

Wall Boxes and Covers.—The market is in a very disorganized state, for deliveries are poor and apparently are being scheduled with strictness by Eastern manufacturers.

Conduit.—Local deliveries are better, several carloads having been received and redistributed. There are signs that some stocks will actually accumulate during the next few weeks.

Heating Material.—Recent advances in certain lines, especially in irons, have apparently retarded business, although some of this may be due to the usual decrease in demand. Indications are that other manufacturers will raise their prices. For hollow ware, such as percolators, etc., there is an increase rather than a decrease in calls. Waffle irons are especially popular.

Line Material.—Cross-arm braces, machine bolts, lag screws and other pole-line hardware are well stocked, and the call is justifying the large coast stocks accumulated during the past two months.

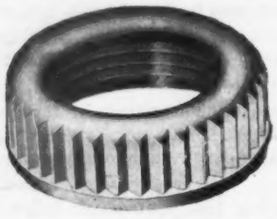
Sewing Machines.—Demand for sewing machines has dropped to a certain extent, and most dealers are well stocked or even overstocked.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Rigid Conduit Bushings

Walker Brothers & Haviland, Otis Building, Philadelphia, are marketing "knurled bushings" for rigid steel conduit. They are made of solid zinc and

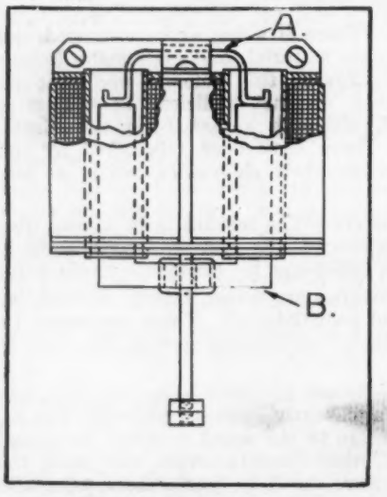


MADE OF ZINC TO OFFSET RUST

are rust-proof, the manufacturer says. The entire outer surface is knurled to fit pliers, and the flange at the bottom covers the hole in the outlet box.

Alternating-Current Magnet

A no-voltage trip coil for use on alternating current is being marketed by the Palmer Electric & Manufacturing Company, Cambridge, Mass., and combines the features of the solenoid and the electromagnet. It consists of a pair of solenoid coils having two opposing U-shaped armatures, which, when the solenoid is energized, float freely in the magnetic field. An alternating-current magnet of this type embodies the long range of action



FOR USE WITH PREDETERMINED LOW-VOLTAGE CONDITIONS

characteristic of the solenoid, with a drop-out feature adjustable through 90 per cent of the voltage range, according to the manufacturer, and chattering is eliminated. In usual construction this magnet operates as a relay, and its use is applicable to low-voltage breakers on circuits subject to a wide range of potential variation and in which it is desirable that the automatic trip be arranged so that it will not operate except upon predetermined low-voltage conditions.

Electric Fountain

An electrically driven fountain has been placed on the market by the Jewel Electric & Manufacturing Company, Ravenswood, Chicago. No water connection is needed as the same water is used over and over. A small universal motor, connected to a small centrifugal pump, circulates the water, drawing it from the basin and projecting it upward through small nozzles to a height of about 14 in., whence it falls over a luminous globe back into the basin. The fountain holds three quarts of water, about one quart a day evaporating into the air.

Lamp-Cord Adjuster

The "Gem" lamp-cord adjuster for ceiling attachment is being marketed by the M. B. Austin Company, 700 Jackson Boulevard, Chicago. An insulator, which carries the lamp cord, is attached to a sheet-metal drum by a heavy cord which is wound up by a spring. Three brass dogs on the drum catch on a shoulder in the steel hanger.

Notes on Recent Appliances

Automatic Arc Welder

The General Electric Company is marketing an automatic arc welder.

Flexible Woven Cable

The Flexible Woven Cable Company, Boston, Mass., is marketing its "Hard-service" flexible woven cable for portable work.

Appliance Connector Plug

The Gray-Heath Company, 1440 Michigan Avenue, Chicago, has brought out a connector plug for household appliances.

Induction-Motor Starting Switch

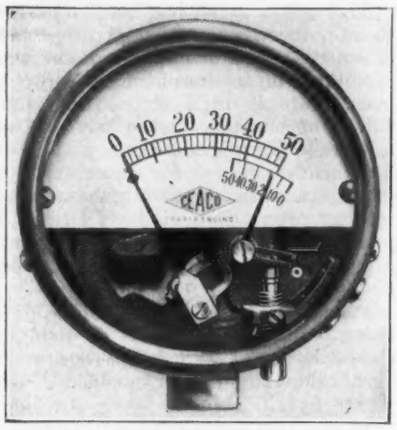
A star-delta starting switch for induction motors is being made by the Union Electric Manufacturing Company, Milwaukee, Wis.

Wireless Regenerative Tuner

The Precision Equipment Company, Cincinnati, Ohio, is marketing a new type of regenerative tuning instrument for wireless receiving circuits.

Automatic Control for Industrial Heating Service

An electric control capable of holding temperatures within 1 deg. and pressures within 0.5 lb. from any set point, says the manufacturer, has recently been placed on the market by the Cobb Electric Appliance Company, Forest Hills, Boston. The device, known as the "Ceaco" control, does away with thermostatic or rheostatic regulations and is designed to control

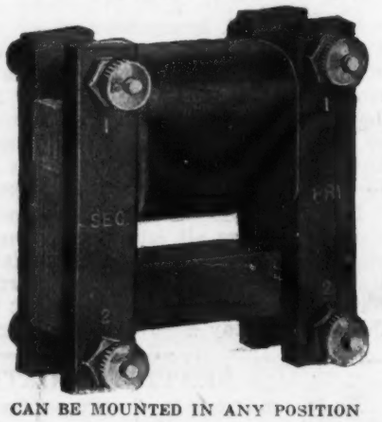


KEEPS CLOSE REGULATION OF TEMPERATURE AND PRESSURE

temperature from 3 deg. Fahr. above zero to any desired degree and any steam or air pressure. For heavy current work a relay contact is used. The control is being used on celluloid tables, dipping tanks, vulcanizers, etc., and is designed to maintain its sensitiveness without adjustment during long periods of continuous use.

Amplifying Radio Transformer

In the amplifying radio transformer, "Arco," developed by A. H. Corwin & Company, 4 West Park Street, Newark, N. J., the coils are wound on a laminated core with a ratio of four to fifteen. The direct-current resistances of the primary and secondary are 1,000 ohms and 5,000 ohms respectively. A



CAN BE MOUNTED IN ANY POSITION

simple mounting is provided, consisting of four binding posts mounted on strips of black bakelite, permitting the instrument to be mounted in horizontal or vertical positions. The weight of the instrument is 2 lb.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

SAMUEL H. TAYLOR, general manager of the Electrical Railway & Manufacturers' Supply Company, San Francisco, Cal., was chairman of the business program committee at the convention of the Electric Supply Jobbers' Association held recently at Del Monte. Mr. Taylor has the distinction of being the oldest jobber, in years of service, on the Pacific Coast, as he has directed the destinies of the Electric Railway & Manufacturers' Supply Company since its organization in 1898.

W. M. McKINSTRY is in charge of the Chicago district sales office, McCormack Building, of the George T. Ladd Company, Pittsburgh, Pa.

THE FAFNIR BEARING COMPANY, New Britain, Conn., has recently appointed Rufus N. Hemenway manager of the industrial bearings division, which includes the sale of double bearing transmission boxes.

THE ELECTRIC SPECIALTY COMPANY, Stamford, Conn., manufacturer of fractional-horsepower motors for special requirements, during the past year has made extensions to its plant, more than doubling the former capacity. It has a large volume of unfilled orders and finds it necessary to decline a large percentage of the business now being offered.

CHARLES F. KETTERING, president of the Delco Light Company, was recently elected president of the Engineering Club of Dayton, Ohio.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, held a sales conference at its works at Bethlehem, Pa., on June 14, 15 and 16. In addition to regular business conferences and inspection trips through the works, there were several social functions.

THE FRANK ADAM ELECTRIC COMPANY, St. Louis, has recently opened warehouses in Detroit, Pittsburgh, New Orleans and Minneapolis, where stocks will be carried for local distribution.

THE ALLAN MANUFACTURING & WELDING CORPORATION announces the removal of its plant from 520 Ellicott Street to 163 Adams Street, Buffalo, N. Y., effective July 1.

THE YALE & TOWNE MANUFACTURING COMPANY, New York City, has elected Willard L. Case as secretary, effective July 1, though he will not take office till Sept. 1. Mr. Case succeeds John B. Milliken, who recently resigned.

THE SUNLIGHT ELECTRIC COMPANY is now located in the Insurance Exchange Building, 175 West Jackson Boulevard and Wells Street, Chicago.

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY, Hartford, Conn., has filed a notice of an increase of $184,950 in capital stock.

THE PETTINGELL-ANDREWS COMPANY, Boston, Mass., held its employees' outing at Nantasket Beach last month, at which about 250 persons were present.

THE HOPEWELL INSULATION & MANUFACTURING COMPANY, Hopewell, Va., will soon place in operation a plant for the manufacture of hard-rubber, composition and molded insulation parts and high-tension insulators for wireless and transmission purposes.

THE FEDERAL BATTERY SERVICE, INC., 1525 Seventh Street, N. W., Washington, D. C., manufacturer of batteries, etc., is planning extensions to its service, including the establishment of stations in other large cities.

THE H. S. B. W.—COCHRANE CORPORATION, Philadelphia, successor to the Harrison Safety Boiler Works, has acquired a group of factory buildings, including machine shops, foundry and offices, at 3120 North Seventeenth Street. The new plant will be utilized by the company in connection with its standard power-plant equipment and specialties.

THE ST. LOUIS ELECTRICAL WORKS announce the appointment of J. F. Jones as sales manager. Mr. Jones was connected with the sales department of the Wagner Electric Manufacturing Company for eleven years. Previous to that he was with the General Electric Company for eight years in the sales department.

E. T. USTICK, JR., formerly with the Blue Bird Washing Machine Company, St. Louis, has taken over the distribution of the lighting plants manufactured by the Universal Products Company, Sandusky, Ohio, and Oshkosh, Wis., in Missouri territory tributary to St. Louis and the southern portion of Illinois. Mr. Ustick has established an office at 416 Title Guaranty Building, St. Louis, and has associated with him William Attebury, formerly of the Mississippi Valley Trust Company.

THE ANDERSON ELECTRIC & EQUIPMENT COMPANY has removed its works to a factory building at 154-160 Whiting Street, Chicago, where it has much larger quarters.

THE NEBRASKA MOTOR POWER COMPANY, Grand Island, Neb., has established a main office at 202 South Twenty-fourth Street, Omaha. The company acts as distributer for the Matthews electric light and power plants, "Motor Marvel" electric washing machines, "America" vacuum cleaners and McClelland ice refrigerating plants for western Iowa, Nebraska and part of South Dakota. It also contemplates handling a large number of other electric household specialties.

THE CARBORUNDUM COMPANY, Buffalo Avenue and Eighteenth Street, Niagara Falls, N. Y., has made arrangements for rebuilding the portion of its works recently destroyed by fire. The cost is estimated at about $50,000.

THE HERTNER ELECTRIC COMPANY, Cleveland, Ohio, contemplates the construction of a factory for the manufacture of electrical supplies on Elmwood Avenue, near Berea Road.

THE KUHLMAN ELECTRIC COMPANY, Bay City, Mich., has filed notice of an increase in capital stock from $75,000 to $150,000 to provide for extensions and its increasing business.

THE AJAX ELECTRIC SPECIALTY COMPANY, St. Louis, Mo., is issuing $100,000 in 8 per cent cumulative preferred stock and $5,000 in common stock in order to permit the company to increase its facilities to handle the business in view.

FREDERIC W. ERICKSON and HENRY M. TAYLOR, consulting engineers, announce the opening of offices at 383 Madison Avenue, New York City, for the practice of electrical, civil and mechanical engineering.

J. E. JENNINGS, vice-president and secretary of Milliken Brothers Manufacturing Company, New York City, has recently sailed for Europe for an extended tour. The company has recently secured a large European contract for galvanized-steel transmission towers.

E. S. LINCOLN, INC., 534 Congress Street, Portland, Me., consulting electrical engineer, is successor to Lincoln, Hanson & Abbott, Inc. Mr. Hanson and Mr. Abbott are no longer connected with the firm.

PARSONS, KLAPP, BRINCKERHOFF & DOUGLAS, formerly Barclay, Parsons & Klapp, announce the removal of their general and engineering offices from 60 Wall Street to their own building at 84 Pine Street, New York City; also the executive offices of their subsidiary and operated corporations and properties and the Parklap Construction Corporation.

THE JACKSON ELECTRIC MOTOR REPAIRING COMPANY, Bellevue Avenue, Trenton, N. J., is planning to erect a one-story building, 42 ft. x 100 ft., to cost about $10,000, on property recently acquired on Belvidere Street.

THE DOMESTIC VACUUM CLEANER COMPANY, 41 Jackson Street, Worcester, Mass., has recently acquired the plant of the Worcester Machine Screw Company, which it will remodel and put into operation before the end of the year.

DWIGHT P. ROBINSON & COMPANY, INC., 125 East 46th Street, New York City, is the name of the organization resulting from the consolidation of Dwight P. Robinson & Company with Westinghouse, Church, Kerr & Company, Inc. The name of Westinghouse, Church, Kerr & Company, Inc., as used in these columns last week, was used in error, attributable to an absence from the city.

Supply Jobbers' Notes

THE ERNER ELECTRIC COMPANY, 4500 Euclid Avenue, Cleveland, Ohio, has appointed Warner Jones manager of sales. Mr. Jones has been connected with sales work in the electrical field for nearly twenty-two years, having been with the Nungasser Carbon & Battery Company until that company was consolidated with the National Carbon Company; since then he has been sales manager of the Dayton Fan & Motor Company.

THE WESCO SUPPLY COMPANY, Seventh to Eighth Street and Clark Avenue, St. Louis, Mo., distributer of electrical supplies, announces that it has taken on several new lines this year and has abandoned lines. Under a reorganized operating personnel, John L. Buchanan is president, George M. Ellis vice-president and general manager, and L. R. Link secretary and treasurer.

PETTINGELL-ANDREWS OUTING NUMBERED ABOUT 250 PERSONS

THE WESTERN ELECTRIC COMPANY, 195 Broadway, New York City, has opened a new supply sub-warehouse at 930 West Ryan Avenue, Youngstown, Ohio. C. A. Strouss is in charge of sales.

Foreign Trade Notes

S. FUKUNAKA, chief engineer of the Nippon Electric Power Company, Osaka, Japan, is in America to buy equipment for a new hydro-electric development which will transmit power about 200 miles into Osaka. Headquarters are established at the Japanese-American Trade Bureau, Longacre Building, Broadway and Forty-second Street, New York City.

GLASS INDUSTRY IN CZECHOSLOVAKIA.—The production of the glass factories in Czechoslovakia is constantly increasing. Twenty-four factories manufacturing lighting fixtures, globes, shades, etc., are operating at 60 per cent capacity. Before the war 80 per cent of these products manufactured in the former Austro-Hungarian Empire were exported.

THE WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, East Pittsburgh, Pa., has appointed the following as foreign managers: F. M. Rodgers, London, England, European manager; J. W. White, Royal Bank of Canada Building, Havana, Cuba, manager for Cuba, and L. T. Peck, Bartolome Mitre, 754, Buenos Aires, manager for Argentina.

SMALL ELECTRIC LIGHT PLANTS IN CHINA.—With the return from abroad of numerous wealthy Chinese who are establishing themselves in the Amoy district, at a distance from the regular electric service stations, it is thought in that country that a market will develop for small electric generating plants. A branch of a Shanghai agency for such plants has already been opened there, in charge of an American-trained Chinese electrical engineer.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning this number.

A man in Costa Rica (No. 33,155) desires to purchase electrically driven emery wheel grinders.

A manufacturing company in Austria (No. 33,170) desires to purchase for immediate shipment about 300 metric tons of sheet iron for generators and about 100 tons of high-alloy sheet iron for transformers.

An electrical engineer in Scotland (No. 33,175) desires to purchase open-air switches and fuses for transmission lines of 22,000 volts.

Trade Publications

INSULATION.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued miniature catalog 5-A-1, in which it describes its insulating materials and supplies.

SUPERHEATERS.—The Locomotive Superheated Company, New York City, has issued bulletin No. T-6, on superheaters for stationary power plants.

TRANSMISSION LINES.—The British Aluminum Company, Ltd., 109 Queen Victoria Street, London, England, is circulating a booklet entitled "From the Falls to the Factory" in which it gives special attention to American practice in transmission-line engineering.

ELECTRIC SUPPLIES.—The Electric Service Supplies Company, Philadelphia, New York and Chicago, has issued catalog No. 6, covering all its products. The book contains 608 pages giving price lists and other data on its apparatus, including marine searchlights, turbo-generators, headlight switches, armature repair machinery, coil-winding machinery, etc.

OIL CIRCUIT BREAKERS.—The Westinghouse Electric & Manufacturing Company has issued six bulletins, Nos. L-3965-70, on oil circuit breakers.

New Incorporations

THE COURTLAND (MINN.) ELECTRIC COMPANY has been incorporated with a capital stock of $25,000 by Max Friederich and others.

THE ROLETTE (N. D.) MILL & LIGHT COMPANY has been incorporated by George Mongeon and others. The company is capitalized at $15,000 and proposes to operate a flour mill and light plant.

THE HOUSTON POWER COMPANY, Dothan, Ala., has been incorporated with a capital stock of $100,000 by J. L. Crawford and others, to construct and operate an electric light and power plant.

THE EMPIRE POWER COMPANY, Anacortes, Wash., has been incorporated to develop water power on the Skagit and Cascade Rivers. The officers are: H. A. Hull, president; Charles Freeman, vice-president, and Fred Lyons, secretary.

THE MADAWASKA LIGHT & POWER COMPANY, Edmundston, N. B., has been incorporated with a capital stock of $300,000 by John M. Stevens, Aaron Lawson and J. Frank Rice, all of Edmundston.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LEBANON, N. H.—The Grafton County Electric Light & Power Company of Lebanon contemplates increasing its developments on the Mascoma River. A new plant will be erected and equipment rated at 800 kw. will be installed, with the possiblity of 400 kw. more. The cost of the project is estimated at about $800,000.

BARRE, VT.—Work will soon be started on construction of a foundation for a new generating unit to be installed in the Pioneer station, of the Montpelier & Barre Lighting & Power Company affording an additional capacity of 3,500 hp.

ST. ALBANS, VT.—The Hemlock and Green Mountain water powers have been sold to the Public Electric Lighting Company of St. Albans, and improvements, including the erection of dams, are contemplated. It is estimated that the plants will generate about 5,000 hp.

LOWELL, MASS.—Commissioners Murphy and Marchand have reported favorably on the petition of the Lowell Electric Light Corporation to lay and maintain underground conduits in West Adams, Wilder and Marginal Streets.

WORCESTER, MASS.—The committee on street lamps is considering the extension of ornamental street lamps from Venice Square to the Lake Bridge and on Main Street from Castle to May Streets.

WORCESTER, MASS.—An appropriation of $31,000 has been made for the purchase of new equipment for the municipal electric light plant, to take care of increased service.

BERLIN, CONN.—The installation of a street-lighting system on Worthington Ridge is contemplated.

NEW HAVEN, CONN.—The Board of Directors of the Springside Farm contemplate the installation of new electrical equipment at the institution.

SOUTH NORWALK, CONN.—The question of increasing the capacity and improving the facilities of the South Norwalk Electric Works is under consideration.

Middle Atlantic States

BROOKLYN, N. Y.—The General Laundries, Inc., Myrtle Avenue, contemplates the construction of a power plant to be used in connection with its factory service.

MARCY, N. Y.—The Utica State Hospital (Marcy Division) contemplates underground electric service connections. Plans call for twelve transformers of various sizes and running electric three-wire feeder in present ducts. The estimated cost is about $18,000.

MORRISTOWN, N. Y.—The Brier Hill Electric Light Company has made application for permission to construct a local electric light plant.

NEW YORK, N. Y.—Contract has been awarded to the Kenn-Well Contracting Company, 841 Broadway, by the New York Edison Company, for the erection of a transformer station on Seventy-third Street, to cost about $150,000.

NEW YORK, N. Y.—Contract has been awarded to John C. Williams, Inc., 233 Broadway, by the Fletcher Company for the erection of a power plant at its factory on Varick Street.

RUSSELL, N. Y.—Application has been made to the Public Service Commission by the St. Lawrence Transmission Company of Potsdam for permission to construct a power plant at Russell.

WATERTOWN, N. Y.—F. W. Woolworth, 233 Broadway, New York, has awarded contract to C. T. Wills, 286 Fifth Avenue, for the erection of a store and office building to cost about $800,000. Jardine, Hill & Murdock, 50 East Forty-second Street, are engineers.

BAYONNE, N. J.—The City Commission has voted to install a "white way" street-lighting system on Broadway from Fifth to Eighteenth Street and from Twenty-fourth to Forty-second Street.

CAMDEN, N. J.—Contract has been awarded to the Raymond Concrete Pile Company, Thirtieth and Schuylkill Streets, Philadelphia, Pa., by the Victor Talking Machine Company for the erection of an addition to the power house at its local plant.

CLAYTON, N. J.—The local lighting company has been ordered by the Borough Council to replace all parts of the distribution system operating with defective wires.

NEWARK, N. J.—Application has been made to the State Board of Public Utility Commissioners by the Public Service Company for permission to issue additional capital stock of $3,000,000, part of the proceeds to be used for additions to equipment and for distribution and transmission lines.

PATERSON, N. J.—Royal Hasco, Inc., Peel Street, will erect a power house at its local textile mill, to cost about $25,000.

PEQUANNOCK, N. J.—The Tri-County Electric Company has been granted permission by the Board of Public Utility Commissioners to issue $17,800 in securities for extensions to its distribution system in Pequannock Township. Energy will be furnished by the municipal plant at Pompton Lakes.

ALLENTOWN, PA.—The Allentown Rapid Service Company will erect an engine, boiler and power house in connection with its new ice-manufacturing plant now under construction at Seventeenth Street and Summer Avenue. The cost, including machinery, will be about $130,000.

ALTOONA, PA.—The erection of a transmission line in the vicinity of Twin Rocks is being planned for by the Penn Central Power Company. Day & Zimmerman, 611 Chestnut Street, Philadelphia, are engineers.

FALLS, PA.—The Boys' Industrial Home contemplates the construction of a dairy at White's Ferry, to cost about $100,000, including the installation of electric light and power equipment.

HARRISBURG, PA.—Applications have been received by the Public Service Commission from the following companies for permission to issue stock for proposed extensions and improvements to electric power plants and systems: Conemaugh Power

Company, Johnstown, $500,000; Palmerton Lighting Company, Palmerton, $17,000; West Penn Power Company, Pittsburgh, $75,000; Beaver County Light Company, Pittsburgh, $33,500.

PHILADELPHIA, PA.—John Friedrich contemplates the erection of a power house at his factory on North Lawrence Street.

PHILADELPHIA, PA. — The Robinson Dairies contemplate the erection of a power house, 95 ft. x 48 ft., and an office building, on Kensington and Hunting Park Avenues.

PITTSBURGH, PA. — Permission has been received by the Duquesne Light Company to erect two high-tension electric transmission lines over the Allegheny River to a point near Colfax, extending to Plum Township. The lines will connect the company's plant at Colfax with the substation at Woodville.

ST. MARY'S, PA.—Bids will be received by F. Arthur Rianhard, architect, Masonic Temple, Williamsport, until July 26, for the reconstruction of a monastery into a hospital building and the erection of a power house, to cost about $100,000.

SOUTH BETHLEHEM, PA.—A proposition has been made to reconstruct and extend the fire alarm and police signal systems in the city, at a cost of about $200,000.

UNIONTOWN, PA.—Bids have been received by the Aaron Furniture Company for the erection of a nine-story mercantile building. Electric light equipment and electric elevators will be installed. Albert Kahn, Marquette Building, Detroit, Mich., is architect.

LEWES, DEL.—The Navy Department, Washington, D. C., has had plans prepared for the erection of a new radio compass station on the old artillery grounds in the vicinity of Lewes Beach.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company will erect a substation on Philadelphia Road, to cost about $42,000.

CUMBERLAND, MD.—The Baltimore & Ohio Railroad, it is understood, is planning for the electrification of about 17 miles of line, from Piedmont to Altamourt, Garrett County. J. H. Davis is chief electrical engineer.

LAUREL, MD.—C. L. Reeder, engineer, Park Avenue and Saratoga Street, Baltimore, has been commissioned to prepare plans and specifications for the erection of a municipal electric distributing plant, to cost about $25,000.

OAKLAND, MD.—Plans are under consideration by the Borough Council for the installation of a new electric light and power system, to cost about $50,000.

PETERSBURG, VA.—Contract has been awarded to the Ambursen Construction Company, 186 Fifth Avenue, New York, N. Y., by the Chesterfield Manufacturing Company for the erection of a hydro-electric plant on Swift Creek.

GREAT CACAPON, W. VA.—The Morgan Power Company has been recently incorporated and a charter has been granted for the development of water power in Morgan and Hampshire Counties.

RIDGELEY, W. VA.—A local electric distribution system will be installed at a cost of about $12,000. The Edison Electric Illuminating Company of Cumberland will furnish the energy.

North Central States

DETROIT, MICH.—Bids will be received by the Public Lighting Commission, 56 East Atwater Street, until July 20 for electric lighting equipment to include conduits, lamp-post foundations for various streets, etc.

DURAND, MICH.—Improvements to the municipal electric light and water plant to cost about $400,000 are contemplated.

JACKSON, MICH.—New construction and improvements involving an expenditure of $6,000,000 are under consideration by the Consumers' Power Company. Plans include the installation of new equipment at Battle Creek station increasing the capacity by 25,000 kw., and the 40,000-volt transmission lines from Owosso and Argena to Battle Creek and from Battle Creek to Jackson will be raised to 140,000 volts. Also a new type outdoor substation will be erected at Grand Rapids Monteith, Argenta, Kalamazoo, Jackson, Muskegon, Flint, Saginaw and Junction Dam.

AKRON, OHIO.—The proposal to issue $1,000,000 in bonds for the erection of a new municipal electric light and power plant was rejected by the City Council.

CLEVELAND, OHIO.—A proposition to issue bonds will be submitted to the voters on Aug. 10 for the purpose of replacing all street and park gas lamps with electric lights.

DELAWARE, OHIO.—A committee appointed by the City Council is considering the erection of an electric light and power plant.

LITCHFIELD, ILL.—The installation of a "white way" street-lighting system in the business section is contemplated.

NEWTON, ILL.—A proposition to issue bonds to the amount of $20,000 for extensions and improvements to the municipal electric light and power plant will soon be submitted to the voters. Fuller & Beard, Chemical Building, St. Louis, Mo., are engineers.

PALMYRA, ILL.—Petition has been filed with the Illinois Public Utilities Commission by the Palmyra Light, Heat & Power Company for permission to extend its lines to Rohrer station and for authority to furnish power to residents along the proposed route.

BIRON, WIS.—A company is being organized for the purpose of erecting an electric transmission line from Biron to Auburndale. A question is under consideration as to the advisability of extending a line to Marshfield.

MILWAUKEE, WIS.—Bids will soon be received by the American Metal Products Company, 671 Kinnickinnic Avenue, for the erection of a machine shop and foundry, 80 ft. x 200 ft. Electric motors will be required.

TWO RIVERS, WIS.—Plans are under way for the construction of a high school to cost about $400,000. John D. Chubb, Dearborn Street, Chicago, Ill., is architect.

MINNEAPOLIS, MINN.—Bids will be received by the Flour State Baking Company until July 15 for electric light and power equipment, freight elevators, etc., to be installed, at a cost of about $40,000, in a new bakery now under construction. Terry-Schulte Engineering Company, Endicott Building, St. Paul, Minn., is engineer.

ST. JOSEPH, MO.—The St. Joseph Heat, Light & Railway Company plans the enlargement of its electric power plant and the installation of new equipment.

ST. LOUIS, MO. — The erection of a power house and morgue building at the Robert Koch Hospital, to cost about $23,000 is contemplated.

CAMPBELL, NEB.—At an election to be held soon the proposition to issue $10,000 in bonds for improvement to the electric lighting system will be submitted to the voters.

Southern States

CAMILLA, GA. — The Baker County Power Company, located at Barnett Shoals on the Notchaway River, is making progress in the erection of a dam as the first step in developing a power plant to supply 250,000 hp. The company also contemplates the construction of a plant of equal capacity at Larks Shoals near Hoggards Mills.

ST. PETERSBURG, FLA.—Bonds to the amount of $28,000 have been voted for extensions to the street-lighting system.

BIRMINGHAM, ALA.—The erection of a power plant to cost about $2,500,000 is contemplated by the Tennessee Coal, Iron & Railroad Company.

FLORENCE, ALA.—A committee has been appointed by the Florence chamber of commerce to investigate the cost of the installation of a hydro-electric plant on Cypress Creek for the purpose of supplying light and power to Florence.

GADSDEN, ALA.—The Lehigh Portland Cement Company plans the erection of an electric transmission line from the plant of the Alabama Power Company to the Cement Company's quarries in eastern Etowah County.

DURANT, MISS.—Bonds to the amount of $81,000 have been voted for the purchase of a new generating unit to be installed at the municipal electric light plant.

LITTLE ROCK, ARK.—Application has been made by the Little Rock Railway & Electric Company for permission to issue $313,000 in bonds, of which $263,000 will be used for improvements to the water plant and $50,000 for the purchase of transformers, meters and other electrical equipment.

TALLULAH, LA.—The Tallulah Light & Power Company contemplates the construction of additions to its plant to cost about $10,000.

ANSON, TEX. — The Anson Light & Power Company contemplates rebuilding its plant recently destroyed by fire.

FLORESVILLE, TEX.—The plant of the Floresville Light & Power Company has been purchased by J. D. Spruce & Sons of Waco, who plan to install an additional plant.

FORT WORTH, TEX.—The Colton Belt Railway Company has awarded contract to the W. C. Hedrick Construction Company, South Western Life Building, Dallas, for the erection of a roundhouse and a number of other buildings, to cost about $185,000. Electric light equipment will be required.

HOUSTON, TEX.—Plans are under consideration by the City Council for the erection of a power plant to cost about $60,000.

KILGORE, TEX.—The installation of an electric light plant in Kilgore to cost about $8,000, is under consideration by the city commissioners.

MERCEDES, TEX.—The Llano Grande Plantation Company, Scanlon Building, Houston, contemplates the construction of a local power house and the erection of a 2,300-volt transmission line in Mercedes.

PORT ARTHUR, TEX. — The Eastern Texas Electric Company plans to erect an addition to its generating station, to cost about $600,000, including the installation of a 4,000-kw. turbo-generator, two 665-hp. boilers with auxiliary equipment and pumps. Stone & Webster, Inc., 147 Milk Street, Boston, Mass., are engineers.

Pacific and Mountain States

HOLLYWOOD, CAL.—A proposition to issue $30,000 in bonds will soon be submitted to the voters for the installation of a proposed ornamental street-lighting system.

STOCKTON, CAL.—The National Paper Products Company contemplates the installation of considerable electrical and mechanical machinery in an addition to be erected at its plant and to cost about $1,000,000.

BRIGHAM CITY, UTAH.—The city officials have decided to replace the present municipal electric light plant with a new and modern generating plant in order to develop the maximum electrical energy on Box Elder Creek.

BONNERS FERRY, IDAHO.—The installation of an electric light plant to cost about $50,000 is under consideration by the City Council.

Canada

CALGARY, ALTA.—Bids will soon be received for the construction of 2,500 miles of rural and toll telephone lines in Alberta.

CALGARY, ALTA.—Plans are under way for the construction of a service building, nurses' home and a power house for the General Hospital. J. B. Richards is city architect.

FORT SASKATCHEWAN, ALTA.—A by-law has been passed authorizing the installation of an electric lighting system. H. F. Greenwood is town clerk.

VANCOUVER, B. C.—The Bridge River Power Company is having plans prepared by W. R. Bonnycastle, architect, 1950 Haro Street, for the construction of a power house. Plans include six units to cost about $5,000,000 each and the development of 400,000 hp.

DESERONTO, ONT.—Bids will be received by R. C. Desrochers, secretary Department of Public Works, Ottawa, until July 13 for the construction of electric wiring to be installed in the Public Building at Deseronto. Plans and specifications may be obtained at the offices of the chief architect, Department of Public Works, Ottawa, the caretaker, Public Building, Deseronto, and the Superintendent of Dominion Buildings, Postal Station "F," Toronto.

NEWMARKET, ONT. — The municipal electric light and water plant was recently destroyed by fire, causing a loss of about $10,000.

TORONTO, ONT. — The United Hotels, King Edward Hotel, has awarded contract to P. H. Secord & Sons, 133 Nelson Street, for the construction of an extension to the King Edward Hotel to cost about $2,000,000. Electric light equipment and electric elevators will be installed.

MONTREAL, QUE.—Bids have been received for the construction of a power house for the Berliner Gram-o-phone Company, St. Antoine Street.

(Issued June 15, 1920)

1,343,208. ELECTRIC ARC-WELDING SYSTEM; Hans Fahnoe, Pittsburgh, Pa. App. filed Sept. 8, 1919. Transformer automatically regulates voltage.

1,343,211. SYSTEM OF CONTROL; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 24, 1916. Regenerative control for electric railway.

1,343,212. STARTING DEVICE FOR ELECTRIC MOTORS; George W. Huey, Wilkinsburg, Pa. App. filed March 8, 1917. Fluid starter.

1,343,221. DYNAMO-ELECTRIC MACHINE; Chester B. Mills, East McKeesport, Pa. App. filed Jan. 5, 1918. Durable field terminals.

1,343,222. STARTING SYSTEM FOR AUTOMOBILES; Chester B. Mills, East McKeesport, Pa. App. filed June 30, 1915. Shifts motor longitudinally.

1,343,242. WELDING TOOL; Richard E. B. Wakefield, Wilkinsburg, Pa. App. filed Nov. 6, 1919. For holding electrode.

1,343,251. CABLE SPLICE; James F. Dillon, Crown City, Ohio. App. filed April 20, 1918. Sleeve with diagonal ends.

1,343,256. SELECTIVELY OPERATED CIRCUIT-CONTROLLING DEVICE; Joseph C. Field, Orange, N. J. App. filed May 18, 1916. Step-by-step telephone control.

1,342,306. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Having pair of input and pair of output circuits.

1,343,307. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Signaling circuits.

1,343,308. DUPLEX TRANSLATING CIRCUITS; John R. Carson, Montclair, N. J. App. filed Sept. 5, 1916. Telephone signaling circuits.

1,343,242. Welding Tool

1,343,345. ELECTRICAL SYSTEM; James M. Brown, Pittsburgh, Pa. App. filed Dec. 2, 1916. Motor control.

1,343,362. ELECTRICAL SIGNALING OR INDICATING APPARATUS ESPECIALLY APPLICABLE FOR SIGNALING ORDERS AND NUMERICAL DATA; Edward A. Graham, Brockley, London, England. App. filed May 16, 1919. Step-by-step telephone signal.

1,343,372. ATTACHMENT FOR SPARK PLUGS; William J. O'Gorman, New York, N. Y. App. filed May 11, 1918. Auxiliary spark gap.

1,343,380. HARD-RUBBER BATTERY JAR AND METHOD OF MAKING THE SAME; Harry Weida, Highland Park, N. J. App. filed Oct. 26, 1916. Devoid of joints.

1,343,393. METHOD OF AND APPARATUS FOR DETECTING AND OBSERVING OBJECTS IN THE DARK; Samuel O. Hoffman, San Francisco, Cal. App. filed April 8, 1919. Detects thermal radiation.

1,343,404. ALTERNATING-CURRENT ELECTROMAGNET; Granville E. Palmer, Boston, Mass. App. filed Dec. 10, 1918. No chatter nor residual effect.

1,343,409. ELECTRIC STARTING AND GENERATING SYSTEM; Elmer H. Schwarz, Glen Rock, N. J. App. filed May 16, 1916. For engine-cranking motor.

1,343,411. STARTING MECHANISM FOR ELECTRIC MOTORS; George E. Slocum, Cleveland, Ohio. App. filed March 9, 1917. Automatic starter.

1,343,451. METHOD AND APPARATUS FOR STARTING MOTORS; John H. Hertner, Cleveland, Ohio. App. filed Dec. 24, 1915. For motor-generator.

1,343,462. TELEPHONE-EXCHANGE AUTOMATIC SWITCHING SYSTEM; Edward A. Mellinger, Chicago, Ill. App. filed Sept. 4, 1908. Non-numerical trunking switch.

1,343,472. COMPRESSIBLE RHEOSTAT; Antonio Papini, Philadelphia, Pa. App. filed March 23, 1920. Reduces commercial voltages for bell ringing.

1,343,475. CUT-OUT SWITCH FOR MINE TROLLEYS; John Racosky, Jerome, Pa. App. filed April 28, 1917. For sectionalizing trolley wire.

1,343,489. SYSTEM FOR INTERCONNECTING MANUAL AND AUTOMATIC TELEPHONE-EXCHANGES; George D. Wolf, Chicago, Ill. App. filed Sept. 14, 1914. For extending connections from manual to automatic substations.

Record of Electrical Patents

Notes on United States Patents

1,343,512. APPARATUS FOR THE TREATMENT OF LOSS OF HAIR ON THE HEAD; Joseph Krauer, Heaton Chapel, near Manchester, Eng. App. filed May 1, 1916. Electric heater.

1,343,524. SAFETY-ZONE INDICATOR; Stanley H. Shackelford, Washington, D. C. App. filed June 1, 1917. Lowered into pavement when idle.

1,343,551. MEANS FOR SUPPORTING ELECTRODE IN IONIC TUBES; Oswald Durdle, London, Eng. App. filed Aug. 9, 1918. Cylindrical anode supported from both ends.

1,343,562. CONTROL MEANS FOR VACUUM-TUBE CIRCUITS; Raymond A. Heising, East Orange, N. J. App. filed Sept. 21, 1915. To change oscillatory conditions.

1,343,573. ELECTRIC LAMP HOLDER; Victorio Martinez, Habana, Cuba. App. filed June 4, 1917. Push-button socket.

1,343,592. TROLLEY; Hency J. Spoden and James B. Welsh, St. Cloud, Minn. App. filed June 30, 1919. Spring in trolley head.

1,343,597. SYSTEM OF ELECTRICAL DISTRIBUTION; William A. Turbayne, Niagara Falls, N. Y. App. filed Nov. 15, 1915. For car lighting.

1,343,599. X-RAY SYSTEM; Harry F. Waite, New York, N. Y. App. filed Oct. 6, 1917. Heating current and X-ray current generated in same transformer.

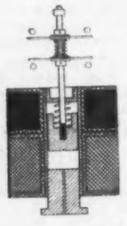
1,343,607. ELECTRIC ARC-WELDING MACHINE; James L. Adams, Jr., and Horace H. Welch, Milwaukee, Wis. App. filed Nov. 10, 1919. Automatic feed.

1,343,662. PROCESS FOR PRODUCING ANHYDROUS ALUMINUM CHLORIDE; Paul Danckwardt, Denver, Col. App. filed June 23, 1919. Electrolysis of molten metal chloride.

1,343,676. CONNECTING PLUG; Sidney J. La Montaine, Chicago, Ill. App. filed Feb. 1, 1919. For heating appliances.

1,343,689. LAMP-DIMMING SOCKET SWITCH; Raymond D. Smith, Arlington, Mass. App. filed Oct. 27, 1916. Varying degree of light through usual pull chain.

1,343,690. HEAT-DISSIPATING SOCKET SWITCH; Raymond D. Smith, Arlington, Mass. App. filed June 5, 1917. For lamp-dimming socket switches.



1,343,411. Starting Mechanism for Electric Motors

1,343,708. SEPARATOR FOR STORAGE BATTERIES; Rufus N. Chamberlain, Chicago, Ill. App. filed Oct. 21, 1918. Made of ribbed wood.

1,343,714. TELEPHONE SYSTEM; Georg Grabe, Nickolassee, near Berlin, Germany. App. filed Jan. 14, 1915. Selective connection of subscribers.

1,343,717. TELEPHONE APPARATUS FOR THE DEAF; Earl C. Hanson, Washington, D. C. App. filed June 11, 1919. Vacuum-tube amplifier.

1,343,719. RELAY; Clinton O. Harrington, Swissvale, Pa. App. filed April 17, 1918. Solenoid windings close to pole pieces.

1,343,751. ADJUSTABLE V-BLOCK AND THE LIKE FOR MAGNETIC CHUCKS; Frank L. Simmons, Woonsocket, R. I. App. filed March 19, 1919. Plurality of magnetizable members separated by non-magnetic material.

1,343,754. APPARATUS FOR TEACHING CODES AS USED IN TELEGRAPHY; Cecil R. Woodland and Reginald Woodland, Liverpool, Eng. App. filed July 5, 1919. For teaching signal codes.

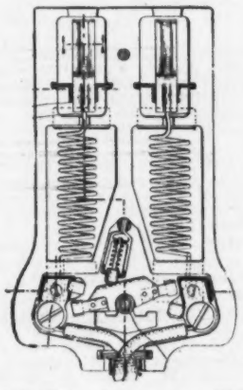
1,343,765. ELECTRIC SYSTEM; John L. Creveling, Tucson, Ariz. App. filed Feb. 9, 1920. Floating battery system.

1,343,848. COFFEE URN; Anson S. Rice, Brooklyn, N. Y. App. filed June 19, 1919. For hotel and restaurant.

(Issued June 22, 1920)

1,343,903. TELEPHONE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 14, 1917. For automatic connection.

1,343,905. ELECTRIC REGULATION; John L. Creveling, White Plains, N. Y. App. filed Aug. 17, 1916. For battery charging.



1,343,676. Connecting Plug

1,343,948. PROCESS FOR PRODUCING CEMENT OF LIQUID SLAGS IN ELECTRIC FURNACES; Karl G. Wennerstrom, Bartange, Sweden. App. filed March 29, 1920. By direct melting without previous mixing.

1,343,957. BATTERY GRID; Franklin R. Bickhart, Philadelphia, Pa. App. filed Dec. 1, 1919. For vehicles.

1,343,989. AUTOMATIC TELEPHONE SYSTEM; Franklin J. Truby, Chicago, Ill. App. filed April 15, 1918. Automatically connects with an idle trunk line.

1,343,996. ELECTRIC HEATING APPARATUS; Edgar F. Collins, Schenectady, N. Y. App. filed Sept. 23, 1919. For electrically heating rivets.

1,344,002. ELECTRIC TREATING AND EXERCISING MACHINE; John B. Kibler, Girard, Pa. App. filed April 30, 1919. Current administered while exercising.

1,344,030. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed Aug. 11, 1917. Extraction of metals from ores with chloride solutions.

1,344,031. PROCESS FOR TREATING LIQUIDS WITH GASES; William E. Greenawalt, Denver, Col. App. filed Jan. 5, 1917. Electrolytic precipitation process.

1,344,052. RADIO-TELEGRAPHY; Roland G. Marx, Palo Alto, Cal. App. filed Aug. 18, 1917. Arc radio transmitters.

1,344,125. PROCESS AND PRODUCT OF ELECTRIC WELDING; Edward Fulda, New York, N. Y. App. filed Nov. 23, 1918. Spot welding.

1,344,127. METALLURGICAL PROCESS; William E. Greenawalt, Denver, Col. App. filed Nov. 28, 1917. Treatment of mixed sulphide and oxide ores.

1,344,153. PRODUCTION OF ALUMINUM NITRIDE AND THE LIKE; Mark Shoeld, Chicago, Ill. App. filed July 10, 1919. From alumina, carbon and nitrogen-containing gas.

1,344,195. TELEPHONE SYSTEM; George A. Yanochowski, Chicago, Ill. App. filed March 25, 1916. Subscriber disconnected on hanging up receiver.

1,344,206. EMERGENCY LAMP; William J. Koenig, Brooklyn, N. Y. App. filed Dec. 3, 1918. For automobile.